TOMBERLIN® CONSUMER DISCLAIMER

Tomberlin® reserves the right to change the suggestions gained in this consumer support site. It is intended primarily for educational purposes only. Some experienced consumers prefer to do the maintenance and service themselves, for the "Do It Yourself" owners, Tomberlin strongly encourages interaction with your local dealer first and to never attempt a procedure you are unfamiliar with safely performing. An electric vehicle has a significant voltage that can result in shock, fire and injury if not performed by a professional. Damage to the vehicle can also occur. Some procedures require specific torque settings that when not followed can result in dangerous, possibly life threatening situations. Many errors will not surface immediately. The information herein has generally proven to enhance the life cycle, safety and overall ownership experience when properly followed. Tomberlin assumes no liability for the content provided in this consumer educational section and it is possible that an error with regard to spelling, grammar, nomenclature, and translation is present. Note that the information provided should be treated as live documents meaning they are always in a state of refinement, correction and improvement. Check back often and if printed, check back prior to reliance to assure they remain current. Never attempt to manipulate the vehicle to exceed the speed as required by regulations. The highest speed range for Tomberlin® E-Merge™ PTV's and LSV's are factory set at 15-19 mph as a PTV or 22-25 mph as an LSV. Consumers should always exercise prudent common sense measures, use proper safety gear with tools designed specifically for the task. Always utilize insulated tools around electrical connections. Never exceed your comfort level and when in doubt, stop and call your local dealer. Tomberlin Authorized Dealers are always your best resource. If you notice an error or have an idea that will improve our efforts here, please email your idea to info@tomberlin.net.





Maintenance Manual 2010 E-Merge

INTRODUCTION

This Maintenance Manual is compiled by TOMBERLIN Company for dealers authorized by the Company and their technicians. The Manual is only for the maintenance and repair of electric vehicles of E-MERGE series.

TOMBERLIN reserves the rights to revise the specifications and design from time to time and the electric vehicles and other products. are subject to improvement that may influence the maintenance procedure with no notice, nor obligation to alternate devices sold previously.

Before starting any service on the electric vehicle, read the Manual carefully and note the difference of the following symbols:

This indicates Note! Alarm! Watch your safety!

The symbol indicates a danger may occur, calling the attentions of the driver, passenger, by stander or inspection and maintenance personnel.

CAUTION

It describes some special precautions to avoid vehicle damage.

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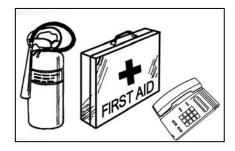
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Safety Precautions



During the maintenance of these vehicles, the following safety precautions can be taken to prevent serious accidents.



Preparation for an Emergency

To prevent a potential injury or fire hazard, the following simple articles should be prepared. For example:

- First-aid kit
- Fire extinguisher
- Emergency phone

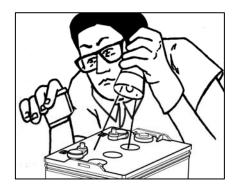


Safe Use of Lubricating Oil

While refilling or replacing oil, do not smoke and keep away from fire.

Any spilled grease should cleaned on a regular basis and be handled properly.





Before maintenance, the battery acid should be sealed.

The battery can give off explosive gases. The battery should be kept away from the ignition source. The liquid level of electrolyte should be inspected with the use of flashlight.

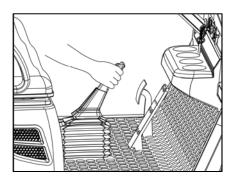
Do not measure and test the voltage after connecting the battery wire. A voltmeter or hydrometer should be used for taking this measurement.

Do not connect the wire with the negative electrode first. Connect it at last.

Do not charge the battery while it is refrigerated. The battery should be unfrozen before it is charged.

To prevent the production of explosive hydrogen gas, the





battery should be placed in an area with good ventilation while charging.

The electrolyte of the battery contains sulfuric acid, which is toxic and highly corrosive and should be prevented from being spilled onto the skins, eyes and clothes. In the event that electrolytes are spilled into eyes, water should be used to clean the eyes for 15 minutes and effective medical treatment should be taken.

WARNING

During the maintenance of these vehicles, the following safety precautions can be adopted to prevent serious accidents.



Vehicle Safety During Maintenance

- The parking brake should be applied.
- Blocks should be placed in front of the front tires.
- No one should be allowed to stand in front of or behind the vehicle being serviced.



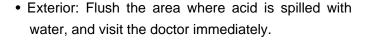
/ DANGER

- Battery contains explosive gas! Smoking is strictly prohibited. Sparks and open flames should be kept away from the electric vehicle and the working area. The place where the battery is charged should be a space where it is kept in good ventilation. While maintaining or working beside the battery, the operator should wear a full face mask and rubber gloves.
- Batteries are toxic and contain acid fluid that may cause serious burns if the fluid should contact the skin. Anti-acid measures:

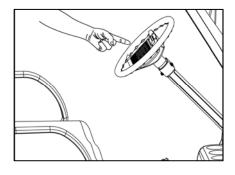


MERGE 1-2





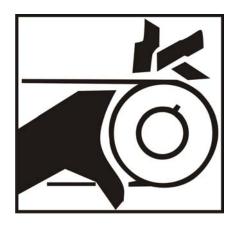
- Oral medication: Drink a large quantity of milk or water before taking milk of magnesia or vegetable oil. Visit the doctor immediately.
- Eyes: If battery acid should contact your eyes, you should flush your eyes with water for 15 minutes and immediately contact your doctor.



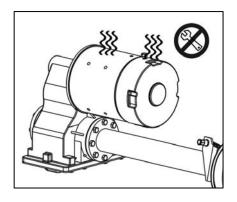
♠ WARNING

- The electric vehicle can only be repaired or maintained by technician with adequate training.
 Even the personnel who are in charge of simple repair or maintenance are required to have the knowledge or experience in relation to electrical and mechanical maintenance.
- Please follow the procedures contained in this Manual, and note all the "DANGER", "WARNING" AND "NOTICE" marks contained in this Manual and attached to the electric vehicle.
- Misuse of electric vehicles or inappropriate maintenance may result in the performance degradation of the vehicle or serious personal injury.
- Any refit or alteration of the electric vehicle that may affect its stability or maneuverability or any speed increase beyond the maximum speed specified in the manufacturer's specifications may result in death and serious personal injury.
- Refer to the user's manual for the corresponding positions labeled on the electric vehicle of all "WARNING" marks and ensure that they are in place and easily visible.
- During the maintenance of electric vehicle, please
 wear the safety goggles or effective eye-shields.
 While maintaining or working beside the battery, the
 operator should wear full face mask and rubber
 gloves. During the maintenance of electric vehicle, it
 is strictly prohibited to wear loose clothes or earrings,
 watches, necklace and bracelets, etc.

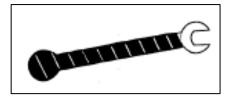




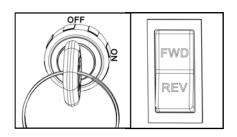




- Moveable elements! It is strictly prohibited to maintain the electric vehicle while it is in operation.
- Hot! It is strictly prohibited to maintain a hot motor. Any violation of this warning may result in serious burns.

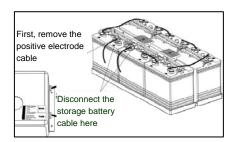


• While working beside the battery or electrical element, the operator should use insulated tools with special care to avoid short circuit of the component or wiring.



• Before servicing the electric vehicle, please turn the key switch to the OFF position and take the key out. Turn FWD/REV switch to NEUTRAL position and chock the wheels with blocks.

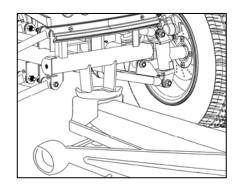




- To avoid unintentional start-up of the electric vehicle, please turn the Tow/Run switch to the TOW position before disconnecting or connecting the battery.
- After disconnection of the battery, please wait for 90 seconds to allow for the discharge of the capacitor in the controller.

NOTICE:

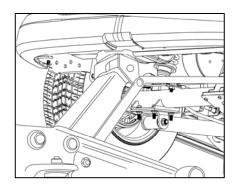
After removing or replacing the wire, please arrange and fix the wiring and wiring harness. Inappropriate arrangement of the wiring and wiring harness may result in the malfunction of the vehicle, property damage and/or personal injury and death.



Use the Designated Lifting Jack

Front: put the lifting jack below the pivot to support it.

Rear: Use the portion of crossed frames.



Caution:

In the case that the lifting jack is placed behind the vehicle, the lifting jack should be prevented from touching the back tower bar.

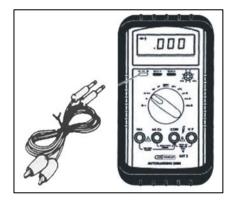


Use Appropriate Tools

To prevent the components and the vehicle from damage, appropriate tools must be used.

Special Tools

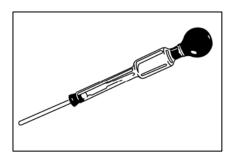
The use of appropriate special tools is necessary for the improvement of vehicles, accurate adjustment and assembly. The use of appropriate special tools can prevent damage resulting from the use of inappropriate tools.



Instrumentation for Electric Control System

1. Pocket detector

This device is of vital importance to the inspection of the electrical control system.



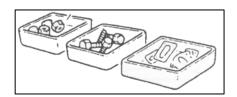
2. Hydrometer

This instrument is designed to measure the precise specific grayte. of the electrolyte.

Cautions

Washing and Cleaning

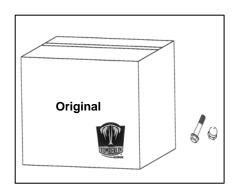
Before the maintenance, thoroughly clean the body and exterior of the components. During the cleaning, care should be taken to protect electrical components such as the relay and controller.



Keep Tidy

To ensure that vital parts are not misplaced, put them in a secure location away from disarray.





Tightening Torque

Tighten the bolts, nuts or screws pursuant to the instructions on the torque in each chapter.

Parts Replacement

We recommend that you use E-MERGE original parts for all replaceable parts. Use the oil or grease recommended by TOMBERLIN during the assembly, inspection and repair.

Washer, Grease Fitting and O-ring

During the inspection and repair of vehicles, all the washers, grease fittings and O-rings removed should be cleaned up before being mounted.

Bearing and Oil Seal

During the mounting of bearing and oil seals on which the manufacturer's mark and number are present, the mark and number should face outwards for easy identification. All the bearing and oil seals, once removed, must be replaced with new ones. To apply the oil seal, cover a thin layer of light lithium grease over the oil seal. While mounting the bearing, the lubricants should be fully applied.

Recommendations on Disassembly and Assembly

Follow the following recommendations to remove and mount the parts:

- Whenever the parts are disassembled, they must be cleaned and air dried.
- Apply the lubricant oil over the surface of the parts that are to be mounted.
- After the mounting of all parts in place, verify that all movable parts are in normal operation.

Chapter 2

Regular Maintenance

Normal maintenance is of paramount importance to the optimal performance and safe operation of vehicles.

WARNING

Unless otherwise required, the master switch must be turned off and the parking brake must be applied during the maintenance.

C–Check **CA**-Check and Adjustment **R**-Replacement **S**-Service **CL**-Cleaning and Lubricating L-Lubricating

	Remarks	Before operation	3100 miles 5000 kilometers (Semiannuall y)	6200 mile 10000 kilometers (Annually)	12400 miles 20000 kilometers (Every two years)	18600 miles 30000 kilometers (Every three years)
	Charging	S	8	S	S	S
	Clean the top of the battery and inspect the retaining screws and terminals for tightness.	S	S	S	S	S
	Inspect the brake pedal for free travel and make adjustments when necessary.	С	CA	CA	CA	CA
Inspectio n before operatio	Inspect the operation of the steering wheel	С	С	С	С	С
n	Inspect the tire pressure and the tire recession and tread for damage	С	CA	CA	CA	CA
	Inspect the body and chassis for damage	С	С	С	С	С
	Inspect all the bolts, nuts and screws for tightness	С	С	С	С	С
	Inspect the reverse buzzer for normal operation	С	С	С	С	С
Monthly inspectio	Inspect the level of the electrolyte		С	С	С	С
n	Inspect all the connecting lines		С	С	С	С



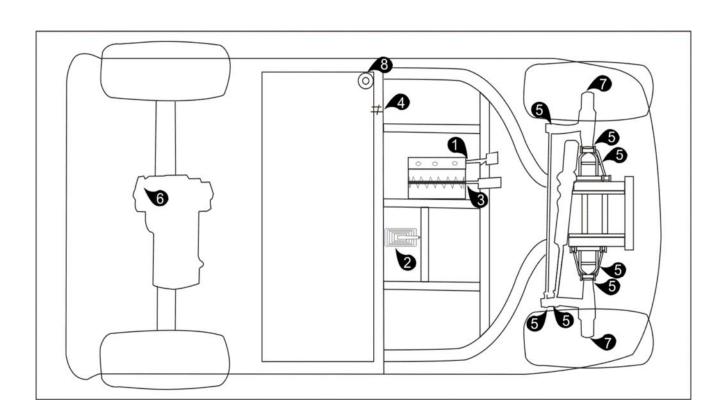
Regular Inspection and Adjustment Chapter 2

			1	1	
	Clean/Lubricate the pedal control area	L	L	L	L
Semian nual inspecti	Inspect all the insulated wires for rupture or dirtiness	С	С	С	С
on	Inspect the shock damper for oil leakage and damage of spring	С	С	С	С
Annual	Conduct discharging test		S	S	S
inspecti on	Use terminal protective agent		S	S	S
	Inspect the brake shoes for tightness and the rear axle bearing for normal operation		С	С	С
	Inspect the steering knuckle bushing for normal operation/Adjust front wheel alignment		CA	CA	CA
	Inspect the nuts of the wheel for tightness and the front-wheel bearing for normal operation		С	С	С
	Replace the lubricating oil in the gear box		R		
	Inspect the parking pedal for free travel and make adjustments when necessary.		CA	CA	CA
Inspectio n every three	Inspect the rear axle bearing and replace it if abrasion is identified				R
years	Inspect for oil leakage, and adjust the gear box when necessary				CA

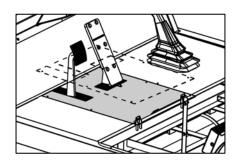
Regular Inspection and Adjustment Chapter 2

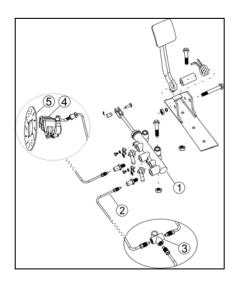
Periodic Lubrication Plan

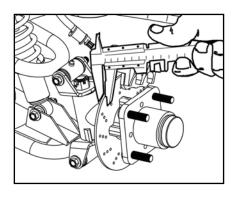
Periodic lubrication plan					
Normal intervals	Maintenance	Lubricated points	Recommend lubricating oil		
	Brake pedal shaft	1	3# Lithium based grease		
The user or trained	Parking brake	2	3# Lithium based grease		
technician applies the	Accelerator pivot bar foot	3	3# Lithium based grease		
lubricating oil once a	Charger receptacle	4	NYE760G		
quarter (every 50	Front suspension	5	3# Lithium based grease		
working hours)	Front stub axle	7	Lithium based grease		
	Braking grease cup	8	DOT3 (3000) brake oil		
The trained technician applies the	Inspect the driving axle/oiled cork position.	6	32.8 ounce (1.1 liter), 37OZ lubricating oil (GL - 5)		
lubricating oil once a year (every 100 working hours)	Inspect the front-wheel bearing (Remount when necessary).	7	3# Lithium based grease		











Braking System

Main Brake Inspection

- 1. Remove:
 - · Anti-slip pedal
 - · Protective cover plate

Care should be taken to avoid scraping the body.

- 2. Inspect:
 - · Brake master cylinder ①
 - Brake Oil Pipeline ②
 - · Tee joint ③
 - · Front wheel brake caliper ④

Oil leakage →if any, replacement is required

· Front wheel brake shoe

Standard thickness

7.0 mm (0.28 in)

Maximum wear value of thickness:

2.5 mm (0.1 in)

· Brake disc

Standard thickness:

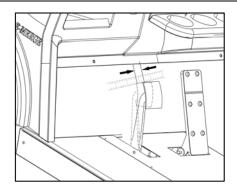
4.0 mm (0.16 in)

Maximum thickness wear value:

1.0 mm (0.04 in)

Damaged/defective one is to be replaced





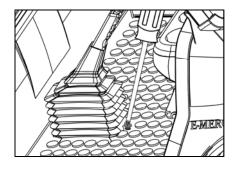
3. Measure:

· Free play of the brake pedal

Push against the pedal by hand (slightly) and measure the distance it travels before the pressure is lost.

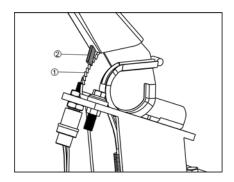
Defects are to be replaced.

Free Travel of the brake pedal 13mm(0.512 in)



Inspection of Parking Brake

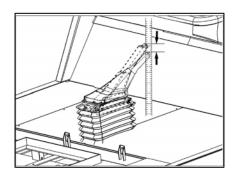
- 1. Turn the key switch to "OFF" position and take out the key.
- 2. Remove the protecting jacket of brake handle.



1. Inspect:

- Parking brake ratchet①
- · Ratchet brake2

Worn or damaged ones are to be replaced.



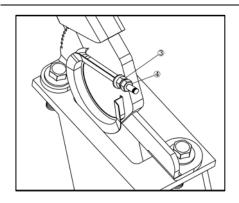
2. Measure:

· Free travel

15mm (0.591in)

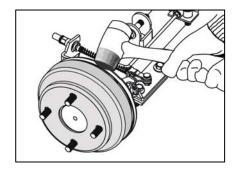
In case of non-compliance with the standard, adjustment is to be made.





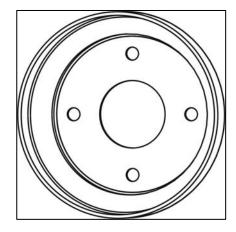
Procedures for the Adjustment of Free Travel

- Loosen the locknut 4
- Adjust the free travel via adjusting nut 3
- · Tighten the locknut
- · Re-inspect the free travel



Inspection of Brake Drum and Brake Shoe

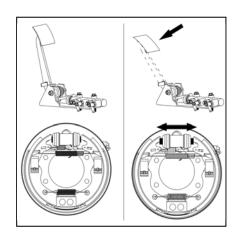
- 1. Turn the key switch to the "OFF" position and take out the key.
- 2. Wedge the blocks onto the front lower part of the front tires. Lift the rear body with the lifting jack.
- 3. Remove the rear tire lug nuts and then the rear wheels.
- 4. Loosen the brake drum and knock slightly on the drum with mallet.



- 5. Inspect:
- Internal surface of the brake drum

Oil → fully clean until no oil is found

Scrape → Rub lightly with the abrasive cloth



· Brake wheel cylinder

Where the upstream assembly is in normal working condition, step on the brake pedal. In case the brake wheel cylinder cannot open the brake shoe or oil leakage is found, the brake wheel cylinder is to be replaced with a new one.



6. Measure

In case the inside diameter of the drum does not meet the specification, it will be replaced with a new one.

Standard inside diameter:

180mm (7.2 in)

Maximum wearing value of the inside diameter:

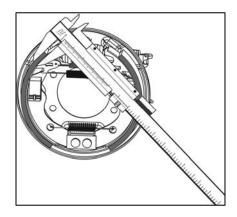
1.5mm (0.06 in)

7. Inspect:

Surface of shoe block

 $\text{Oil} \to \text{Replace}$ the old one or fully clean until no oil is found

 $Scrape \to Rub \ lightly \ with \ the \ abrasive \ cloth$



8. Measure the thickness of the shoe plate, and replace the shoe plate that does not meet the specifications or in case brake shoe block is too old.

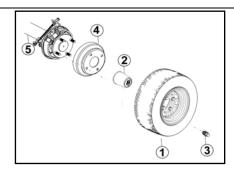
Standard thickness:

7.0 mm (0.16in)

Maximum thickness wearing value:

1.75mm (0.07in)

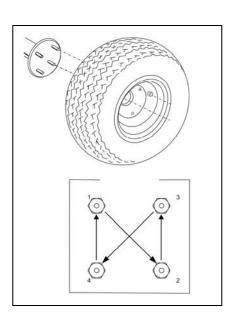
Chapter 2



- 9. Install
 - · Brake drum
 - · Rear wheel

WARNING:

Verify that there is no oil or water on the surface of the brake drum and shoe block.



10. Install:

Wheel nuts

Tightening torque to

90N·m (66.4ft·1b)

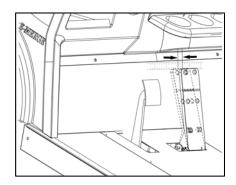
NOTICE:

First, screw on the wheel nuts by hand, and then tighten the nuts diagonally.

11. Upon the completion of the installation, step on the brake pedal about 10 times to adjust the clearance between the shoe plate and the drum.



Inspection of the Accelerator Pedal



1. Inspect:

Operating condition of the pedal

In case of unsmooth operation, the pivot should be lubricated.

2. Inspect:

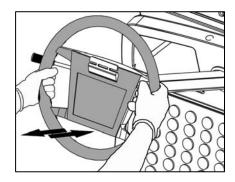
Lateral free travel of the pedal

4mm (0.158 in)

Step on the pedal and replace the pivot in case the free play is too loose.

Limit value to the free pedal travel:

95mm (3.74in), measured at the top of the pedal



Inspection of the Steering System

State of the Steering Wheel in Steering Operation

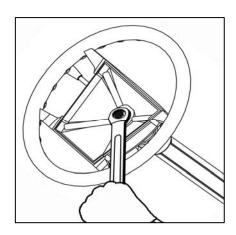
1. Inspect:

Steering clearance

Push and pull or turn the steering wheel. In case of over-looseness, the steering wheel or cross-pin type joint bolts should be tightened.

Limit value to steering clearance of steering wheel:

5° (arc length:15.27mm)



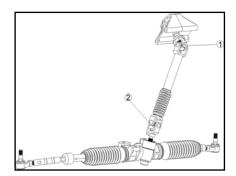
2. Tighten:

Nuts (of steering wheel)

Tightening torque to



50N·m (36.9ft·1b)



And tighten:

Bolts (of universal joint)

Upper fixing bolt

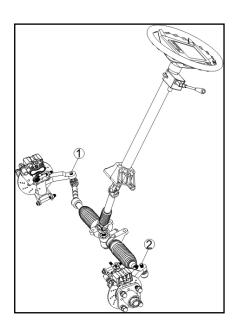
Lower fixing bolt

Tightening torque to

22N·m (16.2ft·1b)

- 3. Re-inspect:
 - · Steering clearance

Inspection of the Steering Linkage Removal of Tie Rod Ball Joint



2. Inspect:

Ball joints in the following conditions:

- · Unsteady operation
- · Over-loose free operation
- · Bending or scrape
- Damage of dust boot

Refer to Chapter 8 "Steering System"

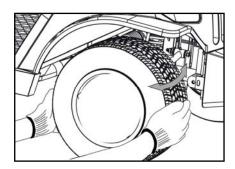
NOTICE:

In case of any of the above conditions, replace with a new ball joint.

3. Install:

Steering Gearbox ball joint.





Inspection of Stub Axle

- · Free gap of kingpin bolt, spacer and bushing
- a. Park the vehicle on flat surface and apply parking brake
- b. Jack up the front wheels of vehicle
- c. Move the wheels lightly

In case the free clearance is too large, the bushing is to be replaced or the bearing clearance is to be adjusted.

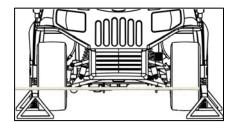
Inspection of the Front Wheel Alignment

Toe-in

- 1. Park the vehicle on flat surface.
- 2. Push the vehicle straightly ahead for about 20 steps to stabilize the suspension.

NOTICE:

Do not pull back the vehicle or step on the brake pedal, as it will leads to changing of toe-in.



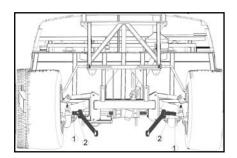
- 3. Measure:
 - · Toe-in

Empty: $5\sim 8$ mm (0.20 \sim 0.32in)

Full load: 0-3mm (0in-0.118in)

In case of non-compliance with standard specified, adjustment is to be made





Procedures for the Adjustment of Toe-in:

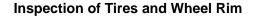
Park the vehicle on the flat surface and apply parking brake.

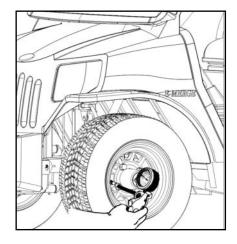
Loosen the locknut(1) on the ends of the tie rod Turn the steering tie rod to adjust the toe-in

Decrease→ rotate the steering tie rod so that the length between two ball joints decreases (toe-in decrease)

- · Tighten the locknut on the drag link ball joints.:
- Tightening torque to

40N·m (29.5ft·1b)





- 1. Measure:
 - · Air pressure

In case of non-compliance with the standard, adjustment is to be made

Tire pressure: (front and rear tires)

200-220kPa

Inspect:

· Tire surface

In case of any abrasion, damage, scrape or inset, the tire is to be replaced.

· Wheel rim

In case of any damage or deformation, the rim is to be replaced rather than go through the motions of inspecting the wheel rim.

2. Measure:

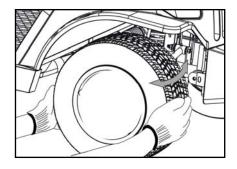




· Wheel tread thickness

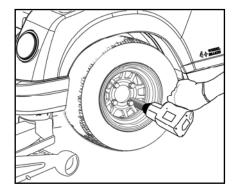
In case of non-compliance with the standard, replacement is to be made

Maximum wearing value of wheel tread thickness (front and rear tires) 4.0mm(0.16in)



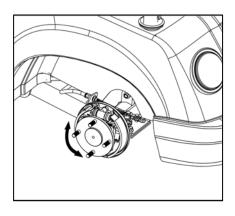
Inspection of the Front Wheel Bearing

- 1. Wedge blocks onto the rear lower part of the rear wheels and lift the front body with lifting jack.
- 2. Move front wheels by hand. Move the front wheel with the Main Shaft being touched. In case the clearance is too large, replace the bearing.



Inspection of the Rear Axle Bearing

- 1. Wedge blocks on the front lower part of the front wheels, and loosen the rear wheel bolts.
- 2. Lift the rear body with the lifting jack.
- 3. Remove:
- Rear wheels
 Brake drum



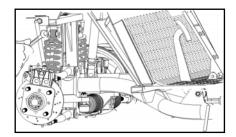
- 4. Slowly rotate by hand the half shaft of rear axle.
- In case of unsmooth or unsteady rotation, the bearing is to be replaced.
- 5. Lightly swing the half shaft of the rear axle. In case that the free gap is too large, the bearing is to be replaced.

NOTICE:

We do not recommend the replacement of bearing and bearing sleeve as an individual part. During MERGE 2-13



the operation, the quality of fit between half shaft and bearing or bearing sleeve may deteriorate. In this case, we usually recommend the replacement of a new rear axle half shaft assembly.



Inspection of the Shock Damper

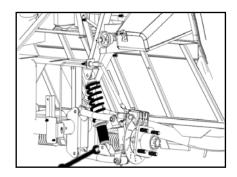
1. Inspect:

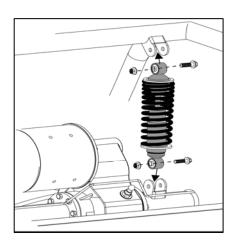
· For oil leakage

In case of oil leakage, the shock damper is to be replaced

Spring

In case of decay, scrape or damage, the shock damper is to be replaced





Mounting bolts of front shock damper:

Tightening torque

63N·m (46.5ft·1b)

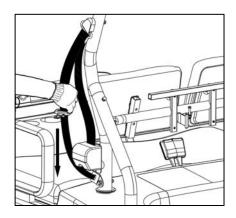
Mounting bolts of the rear shock damper:

Tightening torque

63N·m (46.5ft·1b)

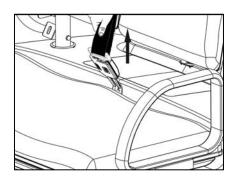


Inspection of the Seat Belt



1. Binding Force of the Seat Belt

Pull down the seat belt swiftly and the retractor should respond quickly to seize the belt. The belt, when loosened, should be retracted back into the retractor. Otherwise, the seat belt assembly is to be replaced with new one.



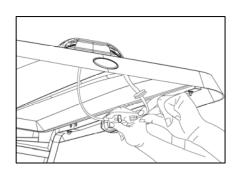
2. Seat Belt Buckle

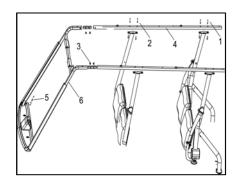
Buckle the seat belt and pull with force the belt near the buckle to verify if the buckle can hold the belt securely.

NOTICE:

In case of damage/scrape/insensitive reaction, the seat belt assembly is to be replaced with a new one.







Removal of the Canopy

Remove:

- Disconnect high—mounted center light wire
- Fixing bolts of the canopy
- 3. Canopy

Install:

Canopy

In the reverse order of the removal procedures

Tightening torque:

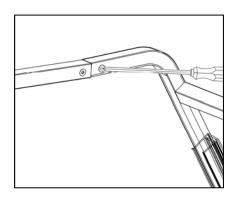
9N·m (6.6ft·1b)

Removal of Canopy Rods

Remove:

- Fixing bolt on the center pillar ② (E-4)
- Install slip bolt ③
- Canopy rod 4 4.
- Fixing bolt of front canopy rod ⑤
- Front canopy rod ⑥





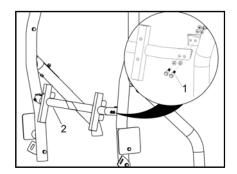
Install:

Connect the front canopy rod and rear canopy rod, and tighten the connecting slip bolt $\,\, \Im \,$

In the reverse order of the removal procedures.

Tightening torque for ①, ②, ⑤:

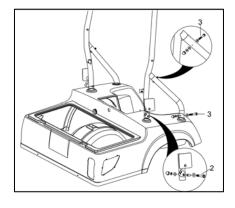
22N·m (16.2 ft·1b)



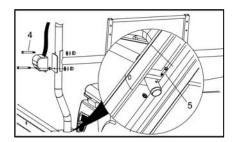
Removal of the Pillar

Remove:

- 1. Fixing bolt of backrest bracket ①
- 2. Backrest bracket



- 3. Fixing bolt on the rear pillar ②
- 4. Fixing bolt on the rear pillar branch ③
- 5. Rear pillar
- 6. Rear pillar branch



- 7. Fixing bolt on the center pillar connector ④ (E-4)
- 8. Center pillar connector
- 9. Fixing bolt on the center pillar ⑤ (E-4)
- 10. Center pillar



Install:

Pillar

In the reverse order of the removal procedures

① Tightening torque:

22N·m (16.2 ft·1b)

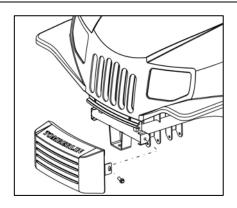
Tightening torque for ②, ④, ⑤:

22N·m (16.2 ft·1b)

③ Tightening torque:

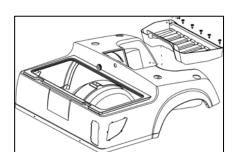
30N·m (22.1 ft·1b)





1. Removal of the Front Bumper Remove:

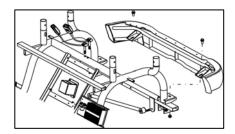
- Bolt
- · Front bumper



2. Removal of the Rear Tray

Remove:

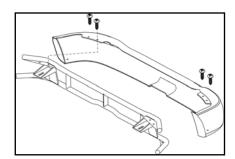
- · Rear box cover
- · Rubber nail
- · Screw
- · Rear tray
- · Clamping nut



3. Removal of the Rear Bumper

Remove:

- Bolt
- · Rear bumper bracket
- Bolt
- · Rear bumper



Install:

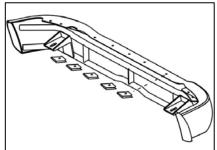
· Front bumper

In the reverse order of the removal procedures

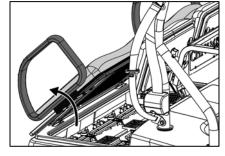
Tightening torque:

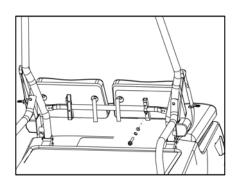
63N·m (46.5 ft·1b)











Install:

- · Rear bumper
- · Rear bumper bracket

Tightening torque: 63N·m (46.5 ft·1b)

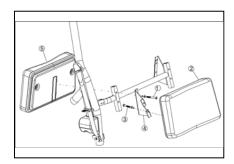
Install:

- Clamping nut
- · Rear tray
- · Rear box cover

Removal of the Seat Cushion Remove

- 1. Removal of the seat cushion:
 - · Handrail fixing bolt
 - · Handrail
 - · Handrail bracket fixing bolt
 - · Handrail bracket
 - · Upper hinge fixing bolt
 - Upper hinge
 - · Bolts on seat cushion bottom plate
 - · Seat cushion
 - Bottom plate of seat cushion
- 2. (E-2) Removal of the Backrest
 - Bolt
 - · Backrest
- 3. (2+2 Series) Backrest Removal
 - · Bolt ①
 - · Rear seat backrest ②
 - Bolt ③





- · Rear seat backrest bracket ④
- Backrest ⑤

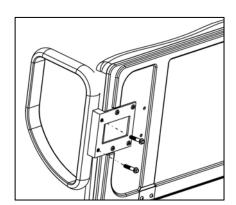
Install:

- · Front seat backrest
- · Tightening the torque of bolt:

22N·m (16.2 ft·1b)

- · Rear seat backrest (2+2 series)
- · Tightening the torque of bolt:

22N·m (16.2 ft ·1b)

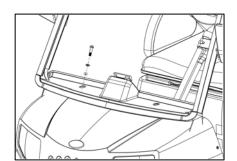


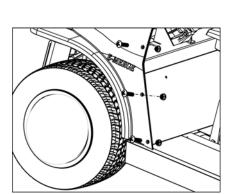
- · Seat cushion
- \cdot Bottom plate of seat cushion
- · Bolts on seat cushion bottom plate
- · Handrail bracket
- · Handrail bracket fixing bolt

Tightening torque:

22N·m (16.2 ft ·1b)







Removal of Front Cover

Remove

- 1. Remove:
- · Front canopy rod

NOTICE:

Refer to "Removal of Canopy Rod" on page 3-1.

- · Instrument panel
- · Rubber nail on the upper dashboard
- · Fixing nuts on the lower dashboard

Tightening torque:

22N·m (16.2 ft·1b)

· Fixing bolt on the lower dashboard

2. Remove:

· Front cover nuts

Tightening torque:

9N·m (6.6 ft·1b)

· Front cover bolts

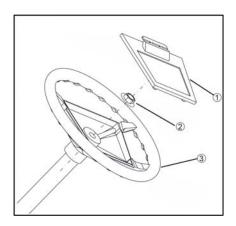
3. Remove:

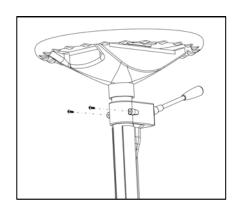
· Front cover

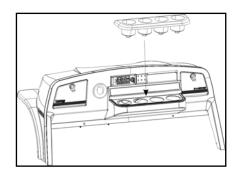
Install:

In the reverse order of the removal procedures.









Removal of the Dashboard

Remove

- 1. Remove:
 - · Steering wheel cover ①
 - · Steering wheel nuts ②
 - · Steering wheel ③

NOTICE:

To remove the scorecard clip, first remove the screws behind the steering wheel cover.

2. Remove:

- · Combination switch connection sheath
- · Fixing rubber nail on the upper dashboard
- · Fixing bolt on the lower dashboard

Disengage the dashboard

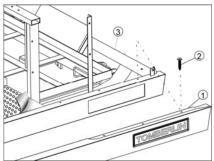
3. Disconnect:

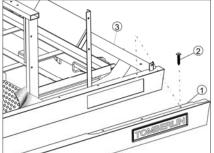
- · Connecting line of main switch
- Connecting line of coulomb meter
- · Steps connecting line
- · Connecting line of multi-functional receptacle
- Plug-in modules of combination switch connecting line

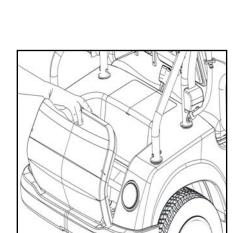
4 Remove:

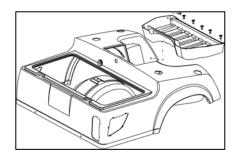
- · Dashboard
- · Combination switch
- 5. Disengage the clasp and remove the cup holder.
- 6. Disengage the clasp and remove the baffle.
- 7. Remove:











- · Edging fender
- · Anti-slip pedal

Install:

In the reverse order of the removal procedures Tightening the torque of steering wheel nuts: 50N·m (36.9ft·1b)

Removal of the Rear Cover

Remove:

- 1. Remove:
 - · Seat cushion
 - · Seat backrest
 - · Pillar

NOTICE:

Refer to "Removal of Seat Cushion" on page 4-3.

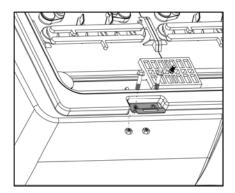
Refer to "Removal of Pillar" on page 3-2.

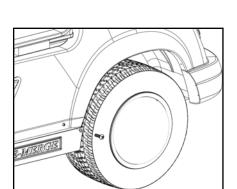
- 2. Remove:
 - · Rear box cover
 - · Rubber nail
 - · Screw
 - · Rear tray

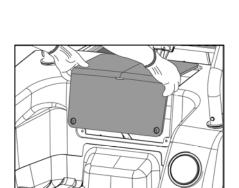
Refer to "Removal of Rear Tray" on page 4-1.

- 3. Disconnect:
 - · Rear light connecting line









4. Remove:

· Fixing bolts of lower hinge

Tightening torque:

7N·m (5.2 ft·1b)

- · Hinge
- · Rear cover bolt

Tightening torque:

9N·m (6.6 ft·1b)

5. Remove

- · Rubber nail of rear cover plate
- · Rear cover plate
- · Rear cover

Install:

In the reverse order of the removal procedures.

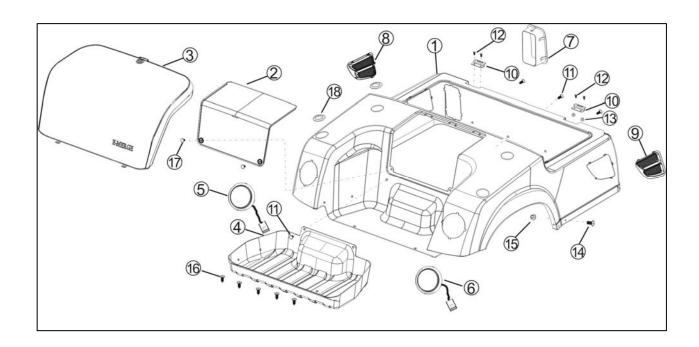


Rear cover

- 1. Rear cover
- 4. Tray
- 7. On-board charging plug box
- 10. Lower hinge
- 13. Nut
- 16. Screw

- 2. Rear cover plate
- 5. Left rear light
- 8. Left ventilating window
- 11. Rubber nail
- 14. Large pan-head bolt
- 17. Rubber nail

- 3. Rear box cover
- 6. Right rear light
- 9. Right ventilating window
- 12. Screw
- 15. Nut
- 18. Rubber cover of rear pillar





Front axle

1. Upper swing arm 2. Split pin 3. Front shock absorber 4. Spindle

5. Lower swing arm 6. Brake disc 7. Oil seal 8. Cone bearing

9. Lower lug shaft 10. Hub connected plate 11. Large dust cover 12. Wheel nuts

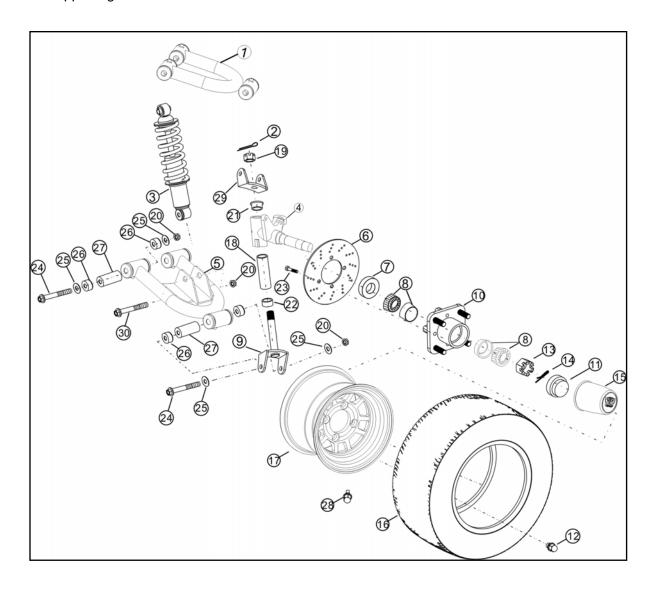
13. Slotted nut 14. Split pin 15. Wheel rim decorative cover 16. Front wheel

17. Front wheel rim 18. Inside spacer of Spindle 19. Slotted nut 20. Nut

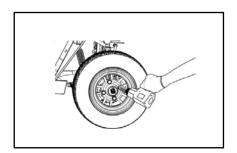
21. Upper bush 22. Lower bush 23. Bolt 24. Bolt

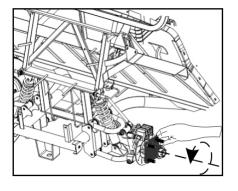
25. Dust cover 26. Nylon bush 27. Inside spacer of swing arm 28. Air valve

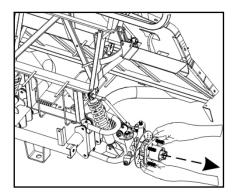
29. Upper lug 30. Bolt











Removal of the Front Axle Remove

- 1. Park the vehicle on level ground.
- 2. Apply the parking brake.
- 3. Loosen: (front wheel) nuts
- 4. Lift up the front wheels with lifting jack.

Refer to Chapter 1 "Uses of Lifting Jack".

- 5. Remove:
- · (Front wheel) nut
- · Front wheel

6. Inspect:

· The operation (of wheel bearing)

Rotate the hub connected plate by hand

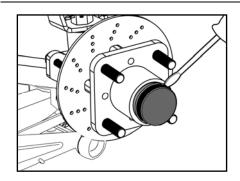
In case of unsmooth operation, the bearing is to be replaced with new one.

7. Inspect:

· Free gap (of wheel bearing)

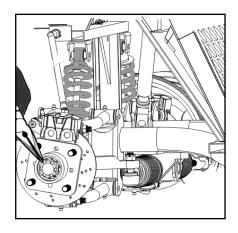
Swing the hub back and forth. In case the free gap is too large, the slotted nut is to be tightened. In case the clearance is still too large, the bearing is to be replaced with new one.





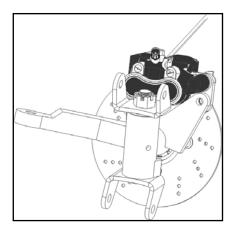
8. Remove:

· Dust cover



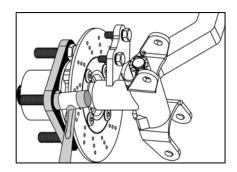
9. Remove:

- Split pin
- · Slotted nut



10. Remove:

- · Brake tongs bolt
 - Tightening torque
 - 23N·m (17.0 ft·1b)
- · Brake tongs

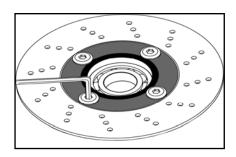


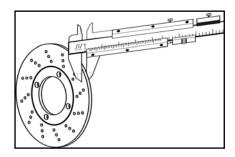
11. Remove:

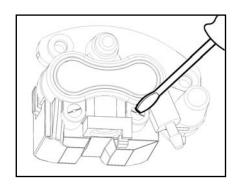
· Hub connected plate (of front wheel)

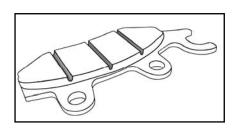
Knock at the connected plate with a soft hammer.

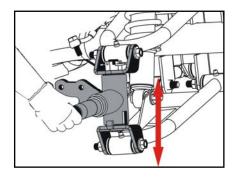












12. Remove:

· Brake disc bolt

Tightening torque

23N·m (17.0 ft·1b)

· Brake disc

Standard thickness of brake disc

4 mm (0.16 in)

Maximum wearing thickness

1 mm (0.04 in)

13. Remove:

- Bolt

Tightening torque

23N·m (17.0 ft·1b)

· Fore wheel brake shoe

Standard thickness

7 mm (0.28 in)

Maximum wearing thickness

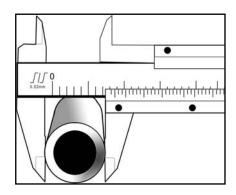
1 mm (0.04 in)

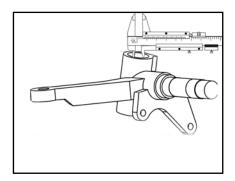
14. Inspect:

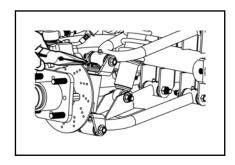
· Spindle free gap

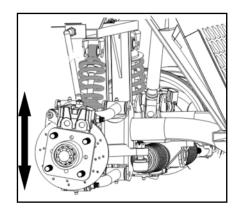
Swing the Spindle. In case the free gap is fairly large, the inside spacer and bush of the Spindle are to be replaced.











NOTICE:

The inside space and bush should be replaced together.

15. Remove:

· Removal of Drag Link Ball Joint

Please refer to Chapter 2 "Removal of Drag Link Ball Joint".

- · Split pin
- · Pivot slotted nut
- · Spindle lug
- · Spindle
- · Inside spacer of Spindle
- · Bush of Spindle

16. Inspect:

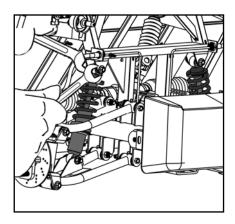
· Free gap of swing arm

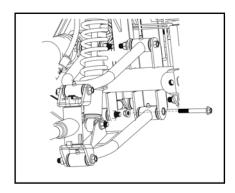
Swing the swing arm. In case the free gap is fairly large, the inside spacer and nylon bush of the swing arm are to be replaced.

NOTICE:

The inside space and nylon bush of the swing arm should be replaced together.







17. Remove:

· Front shock absorber bolt

Tightening torque

60N·m (44.2 ft·1b)

- · Front shock absorber
- · Swing arm bolt

Tightening torque

60N·m (44.2 ft·1b)

- · Upper and lower swing arms
- Dust cover
- · Inside spacer
- · Nylon sheath

Inspect

1. Wheel:

In case of scrape/bending/deformation, the wheel is to be replaced.

2. Hub connected plate

In case of scrape/damage, the hub connected plate is to be replaced.

3. Bearing (of hub connected plate)

In case of unsmooth operation of the connected plate or wheel as a result of the bearing, the bearing is to be replaced.

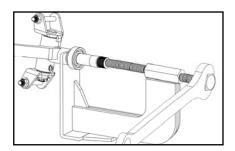
4. Oil seal

In case of abrasion/damage, the oil seal is to be replaced.

Procedures for the replacement of hub connected plate bearing and oil seal cover:

· Clean the interior of hub connected plate.





 Remove the oil seal and bearing with the special bearing puller.

Front Axle

 Install new oil seal cover and bearing in the installation procedures mentioned above.

NOTICE:

Use a hold-down clamp that is consistent with the diameter of bearing and inside loop of oil seal cover.

Caution

Do not knock at the bearing roller and bracket. It is enough that it reaches the center of the inner loop.

5. Spindle

In case of damage/deformation, the Spindle is to be replaced.

6. Front shock absorber

In case of spring deflection/oil leakage and surface scrape, the front shock absorber is to be replaced.

7. Swing arm

In case of damage/deformation, the swing arm is to be replaced.

Install

Move back to the procedures of "removal"

Note the following:

1. Warning

The split pin, once removed, must be replaced with new one.

2. Install:

- · Front wheel
- · Wheel nut (of front wheel):

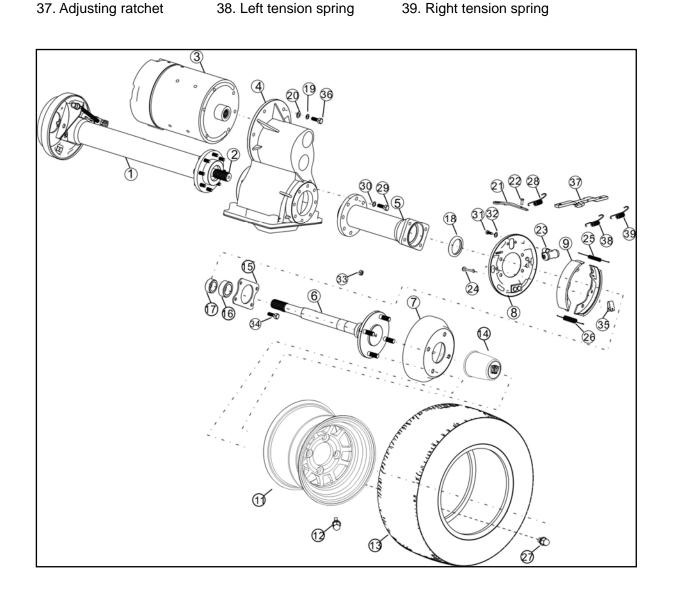
Tightening torque

70N·m (52.0 ft·1b)

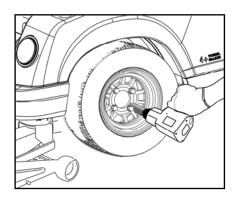


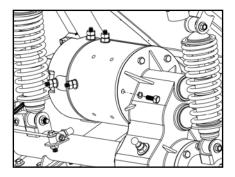
Driving axle

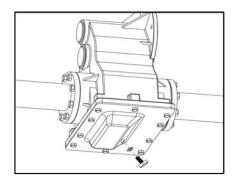
1. Outer tube of left half axle 4. Differential gear 2. Left half axle 3. Electric motor 5. Outer tube of right half axle 6. Right half axle 7. Brake drum 8. Brake base plate 9. Brake shoe plate 10. Cable retaining plate 11. Wheel rim 12. Air valve 16. Bearing 6206 13. Tire 14. Wheel rim decorative cover 15.Retaining plate 17. Bearing fixing bush 18. Oil seal 19. Spring washer 20. Flat washer 21. Brake rocker arm 22. Locating dowel 23. Wheel cylinder 24. Locating dowel 25. Upper tension spring 26. Lower tension spring 27. Wheel nuts 28. Return spring 29. Bolt 30. Spring washer 31. Bolt 32. Spring washer 33. Nut 34. Bolt 35. Clipping spring 36. Bolt

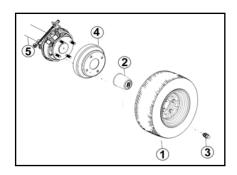












Removal of the Driving Axle

- 1. Park the vehicle on level ground.
- 2. Lift the rear body with the lifting jack before putting a suitable bracket under the frame.

Refer to Chapter 1 "Use of Designated Lifting Jack".

- 3. Wedge blocks onto the front lower part of the front wheels.
- 4. Disconnect:

All the connecting lines of the electric motor.

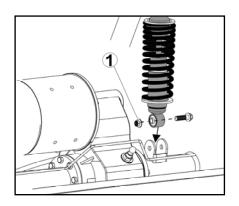
- 5. Remove:
 - · Six bolts of the electric motor
 - · Electric motor

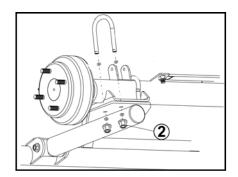
Refer to Chapter 9 "Removal of Motor".

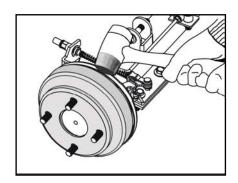
6. Put an oil tray under the differential gear, unscrew the bleeding bolt to discharge all the lubricating oil in the differential case.

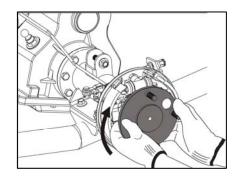
- 7. Remove:
 - · Wheel nut (of rear wheel)
 - · Rear wheel











8. Remove:

- Lower fixing nut of rear shock absorber ①

Tightening torque

63N·m (46.5ft-1b)

· rear shock absorber

 \cdot Rear axle and rear swing arm fixing nut $\ensuremath{\textcircled{2}}$

Tightening torque

63N·m (46.5ft·1b)

- · U-bolt
- · Driving axle

9. Remove:

Brake hub

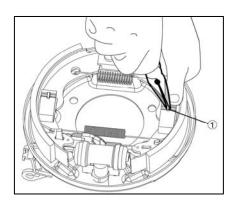
NOTICE:

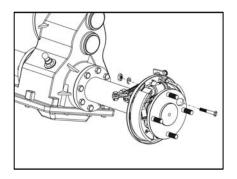
In case the brake hub is difficult to remove, knock out the hub with rubber hammer.

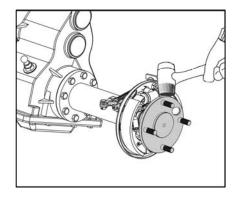
10. Inspect:

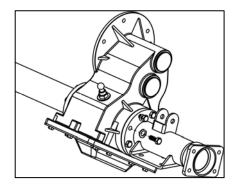
- · Half axle operation
- Rotate the half axle connected plate with hand, and in case of unsteady rotation or abrasion, the half axle assembly is to be replaced.











11. Remove

- · Clipping spring
- · Locating dowel ①
- · Upper and lower brake retracting spring
- · Brake shoe

Turn the locating dowel with spring or pincer pliers to separate the clipping spring and locating dowel of brake shoe.

12. Remove:

- · Fixing bolt of half axle of rear axle
- · Half axle assembly of rear axle
- · Brake base plate

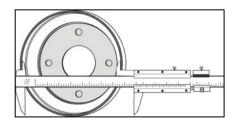
NOTICE:

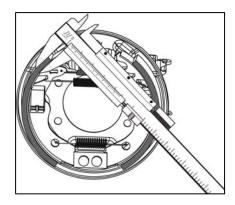
Knock out the half axle wheel rim of the rear axle lightly with a rubber hammer.

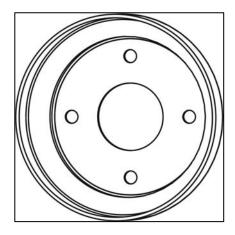
13. Remove:

- · Fixing bolt of half axle outer tube
- Tightening torque
- 55N·m (40.6 ft·1b)
- · Half axle outer tube









Inspect and test

- 1. Measure:
 - · Inside diameter of brake drum
 - · Thickness of brake shoe

Refer to Chapter 2. In case of non-compliance with the specification, replacement is to be made.

2. Inspect

- · Bottom plate of brake shoe plate
- · Brake drum

In case of deformation/scrape/damage, replacement is to be made.

· Half axle assembly of rear axle

In case of scrape/bending/deformation, the wheel is to be replaced.

NOTICE:

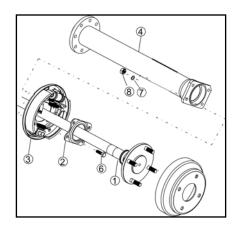
We do not recommend the replacement of bearing and bearing sleeve as an individual part.

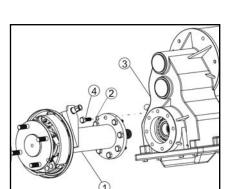
During the operation, the quality of fit between half shaft and bearing or bearing sleeve may deteriorate. In this case, we usually recommend the replacement of a new rear axle half shaft assembly. In addition, due to the complex internal structure of the brake, we recommend that the maintenance personnel replace or adjust one brake with another one as the reference during the service.

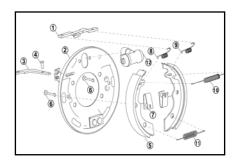
· Rear axle tube

In case of scrape/bending/damage, replacement is to be made.









Install

In the reverse order of the "removal" procedures

Note the following.

- 1. Lubricate:
 - · External surface of the bearing

Basic grease

2. Install:

- · Brake base plate
- · Half axle assembly of rear axle
- Bolt ⑥
- Spring ⑦
- · Nut ®

Tightening torque

22N·m (16.2 ft·1b)

3. Install:

- · Half axle outer tube of rear axle
- Bolt (4)

Tightening torque

60N·m (44.3 ft·1b)

4. Install

- Brake shoe ⑤
- · Upper tension spring ⁽¹⁰⁾
- · Lower tension spring 1
- · Locating dowel ⑥
- Clipping spring ⑦





· Apply the high temperature grease over the two ends of the metal support of the brake shoe.

WARNING

In handling the brake shoe, ensure that the hands are clean and the shoe plate surface is not tainted with grease.



- · Brake drum
- · Rear wheel assembly
- · Wheel nut (of rear wheel)

Tightening torque

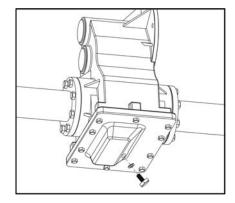
70N·m (51.7 ft·1b)

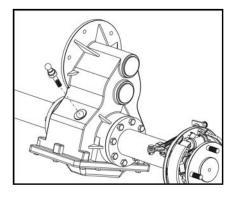


· Bleeding bolt

Tightening torque

70N·m (51.7ft·1b)





Remarks:

Apply 1100mL lubricating oil (GL -4 or GL- 5) to the rear axle.

7. Install

· Oil filler screw plug



Gearbox

1. Gearbox body 2. Bottom cover of differential gear 3. Input shaft 4. Middle gear

5. Middle shaft 6. Oil filler plug 7. Ring gear 8. Differential gear

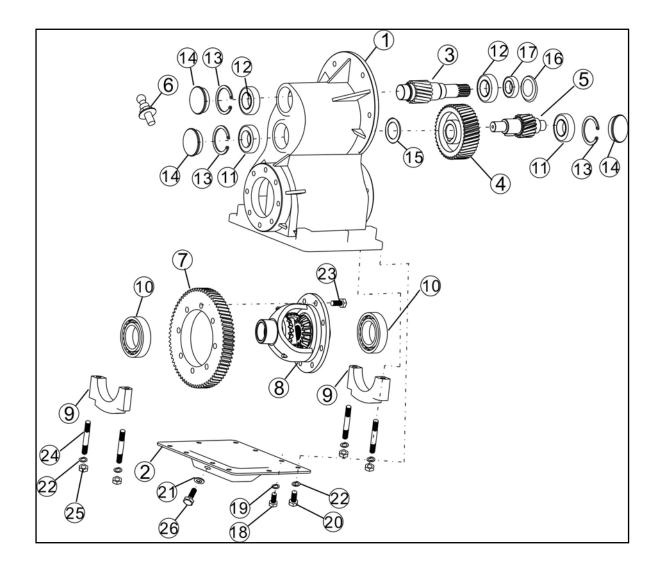
9. Bearing pressing block 10. 6008 bearing 11. Bearing 6303RS 12. Bearing 6005RZ

13. Inner clasp 14. Rubber cover 15. Gear bush 16. Oil seal

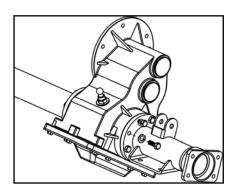
17. Bearing bush 18. Bolt 19. Spring washer 20. Bolt

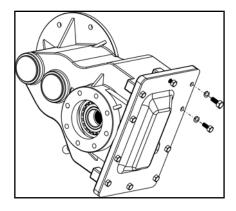
21. Copper washer 22. Spring washer 23. Bolt 24. Stud bolt

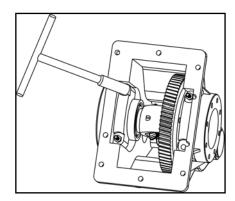
25. Nut 26. Bleeding bolt

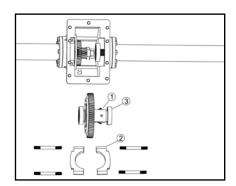












Removal of the Differential Gear

1. Remove:

- · Differential gear
- · Fixing bolt of differential gear
- · Bottom cover of differential gear

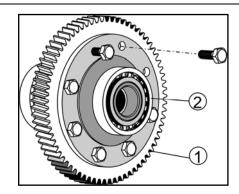
Caution

The bottom cover of the differential gear should be pried up by a flat-head screwdriver. Please note not to damage the sealing surface of the box or deform the bottom cover of the differential gear.

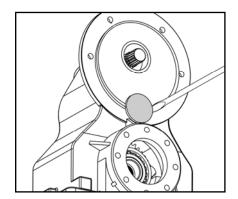
2. Remove:

- · Bearing pressing block bolt
- Bearing pressing block2

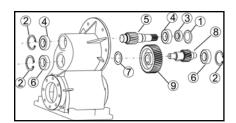




- 3. Disassemble:
 - · Ring gear ①

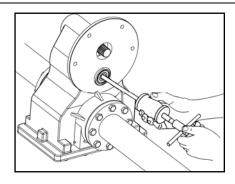


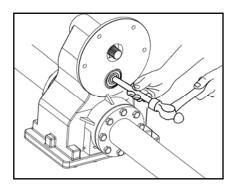
- 4. Remove:
 - · Sealing rubber cover (both ends)
- 5. Remove:
 - · Oil seal ①
 - Clip spring ②
 - Bearing fixing bush ③
 - · Bearing ④
 - · Input shaft ⑤

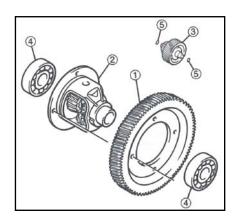


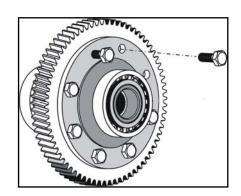
- 6. Remove:
 - $\cdot \ \text{Clip spring (from countershaft gear)}$
 - · Bearing ⑥
 - Gear bush ⑦
 - Countershaft ®
 - $\cdot \ \, \text{Countershaft gear} \ \, \textcircled{9}$











Procedures for the removal of countershaft gear:

- 1. Push out the countershaft gear from the bearing inner ring.
- 2. Remove the bearing with bearing extractor.
- 3. Repeat Step 1 to remove the countershaft gear on the other side.

Inspection

- 1. Inspect:
 - · Ring gear ①
 - · Differential gear assembly

In case of damage or abrasion, replacement is to be made

· Bearing

In case of erosion damage, replacement is to be made

Install

In the reverse order of the removal procedure. Note the following:

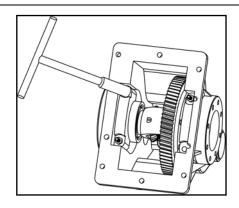
2. Tighten:

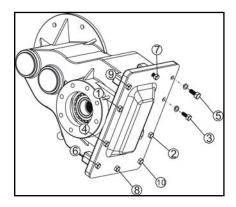
 Differential gear bolt that connects the ring gear and differential gear assembly

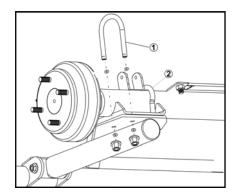
Tightening torque

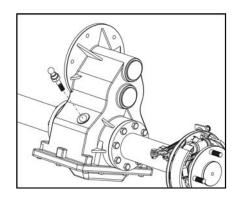
54N·m (39.8ft·1b)











- 3. Tighten
 - Differential bearing pressing block bolt

NOTICE:

Clean the surface of differential gear and box bottom cover.

Apply 856 sealant to differential gear surface and 10 bolt holes.

4. Tighten:

Differential gear bottom cover bolt

NOTICE:

Tighten the bolts diagonally from the smallest type in two phases.

Install:

In the reverse order of the "removal" procedure, and note the following.

1. Install:

Rear axle and rear rocker U-bolt

Tightening torque

50N·m (36.9ft·1b)

2. Apply Oil:

Recommended oil:

GL-4 or GL-5 gear oil

Oil volume: 1100mL

32. Tee tube



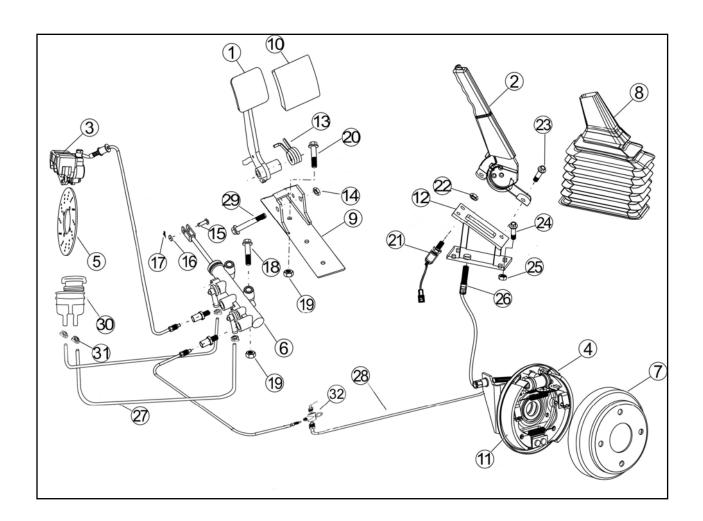
Brake System

29. Bolt

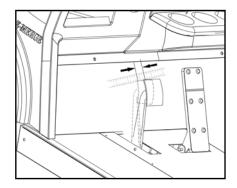
1. Brake pedal 2. Parking brake handle 3. Brake caliper 4. Rear brake 5. Front brake disc 6. Brake master cylinder 7. Brake drum 8. Boot 9. Brake pedal base 10. Brake pedal sealant 11. Brake shoe plate 12. Brake handle base 16. Flat washer 13. Return spring 14. Nut 15. Locating dowel 17. Split pin 18. Bolt 19. Nut 20. Bolt 21. Parking switch 22. Nut 23. Bolt 24. Bolt 27. Oil hose 28. Iron oil tube 25. Nut 26. Cable

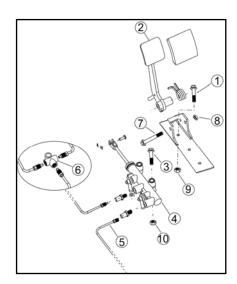
31. Clamp

30. Reservior









Brake Pedal

1. Measure:

· Free play of brake pedal;

13mm (0.512 in)

In case of non-compliance with the specification, the brake master cylinder is to be replaced.

2. Remove

- · Anti-slip pedal
- · Protective cover plate

Refer to relevant content in Chapter 2.

- Brake pedal fixing bolt ①
- · Brake pedal fixing nut 9

Tightening torque

50N·m (36.9 ft·1b)

- · Brake pedal ②
- · Fixing bolt of brake master cylinder ③
- · Fixing nut of brake master cylinder ⑩

Tightening torque

45N·m (33.2 ft·1b)

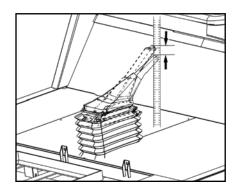
- Brake master cylinder 4
- Brake pipe ⑤
- · Tee tube ⑥

Inspect:

- Brake master cylinder 4
- · Brake pipe ⑤
- · Tee tube ⑥

In case of oil leakage/deformation/damage, replacement is to be made.





Parking brake handle

1. Measure:

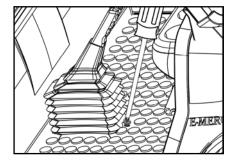
· Free play of parking brake handle;

15mm (0.591in)

In case of non-compliance with the specification, the free play is to be adjusted.

2. Remove

Boot



3. Inspect:

· Hand brake cable

In case of oil leakage/deformation/fall-off, replacement is to be made.





Accelerator pedal

1. Accelerator pedal

2. Accelerator

3. Accelerator bracket

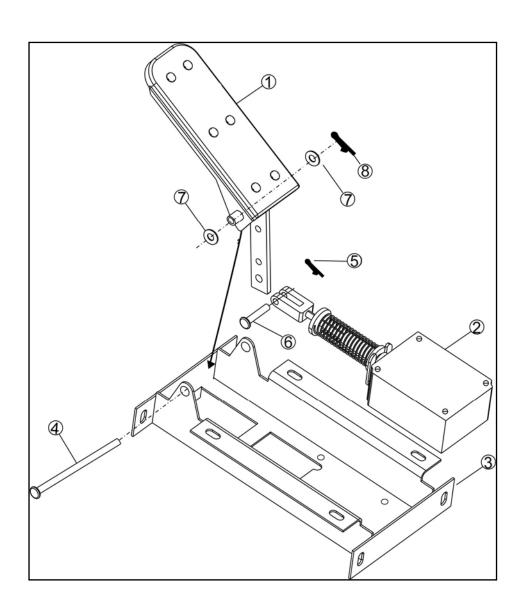
4. Pivot

5. Split pin

6. Pin axle

7. Washer

8. Split pin





Steering system

1, steering wheel 2, cover of steering cover 3, nut of steering wheel

4 bearing 5, inner snap ring 6. steering shaft

8. protective sleeve of steering shaft 7, outer snap ring 9, turn signal stalk

10, protective sleeve for wire harness 11, block of steering column

12、bolt 13、bolt 14、nut 15, universal joint spline

16, spline bearing of universal joint 17、dustproof cover of universal joint 18 nut

19 lock washer 20、 flat washer 21, steering gear housing 22 nut

23 outer snap ring 24 tape 25 dustproof cover 26 adjusting nut

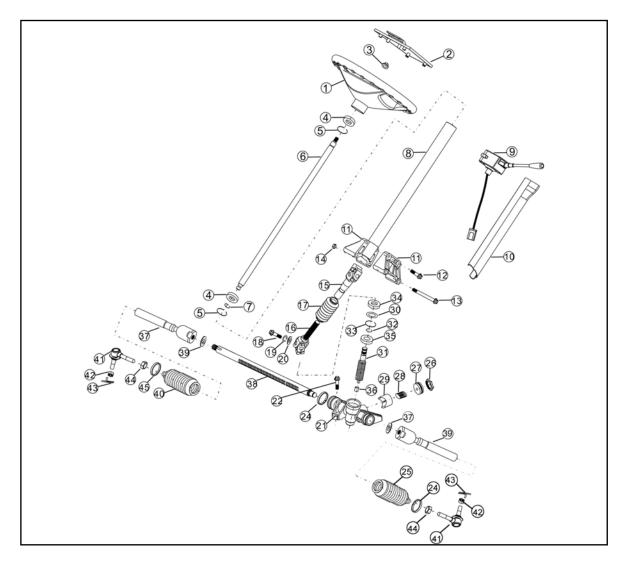
27, adjusting cap 28 stress spring 29 hold downs 30 oil seal

31, small gear bearing 32 inner snap ring 33 outer snap ring 34, dustproof cap

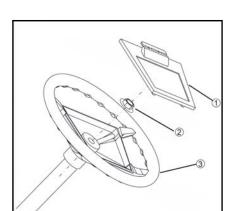
35 bearing 36 bushing 37, steering rod 38 gear

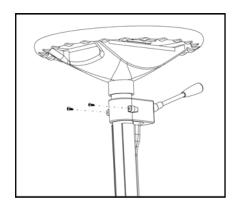
39, stopple washer 40 dustproof sleeve 41 ball joint 42 slotted nut

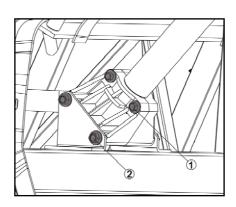
43 cotter pin 44 nut 45 tape











Removal of the Steering System

- 1. Park the vehicle on level ground.
- 2. Apply the parking brake.
- 3. Put a suitable bracket under the frame and lift up the front wheels with lifting jack.

Refer to Chapter 1 "Recommendation for Use of Lifting Jack".

4. Remove:

- · Steering wheel cover plate
- · Steering wheel nuts ②
- · Steering wheel ③

5. Remove:

Dashboard

Please refer to Chapter 4 "Removal of the Dashboard".

- · Disconnect the connecting line of turn signal
- ·Sleeve of turn signal stalk cable
- · Bolt
- · Turn signal stalk

6. Remove:

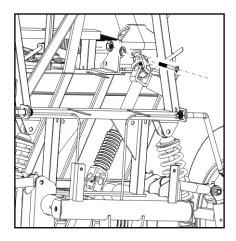
· Upper fixing bolt of the block of steering column ①

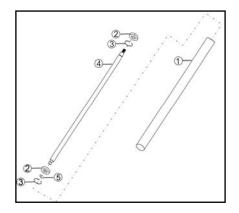
Tightening torque

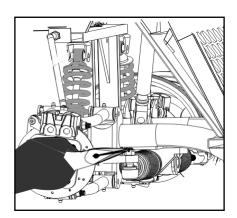
20N·m (14.8 ft·1b)

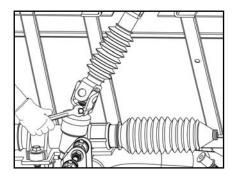
· Lower fixing nut of the block of steering column ②











Tightening torque

50N·m (44.6 ft·1b)

Upper fixing bolt of universal joint ③

Tightening torque

25N·m (18.4 ft·1b)

· Steering column assembly

7. Disassemble:

- Outer clasp (5)
- · Inner clasp ③
- Steering shaft 4
- · Bearing ②

NOTICE:

Press the steering shaft out of the bearing on one side with the hydraulic press, and extract the bearing with universal bearing extractor. Extract the bearing on the other side in the same method. The bearings, once removed, must be replaced with new ones.

Removal of the Steering Gear

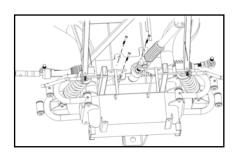
- 1. Remove:
 - · Split pin
 - Slotted nut
 - · Lower fixing bolt on the universal joint

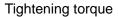
Tightening torque

25N·m (18.4 ft·1b)

- · Universal joint assembly
- · Fixing bolt on the steering gear

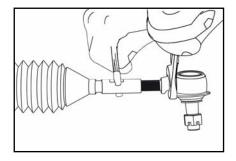






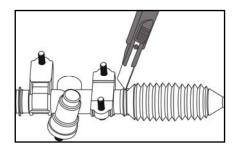
45N·m (33.2 ft·1b)

· Steering gear

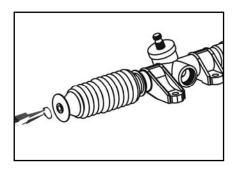


Disassembly of the Steering Gear

- 1. Disassemble:
 - · Drag link ball joint of the steering gear
 - Secure the drawbar of the steering gear with one spanner, and loosen the locknut with another spanner.
 - · Tape

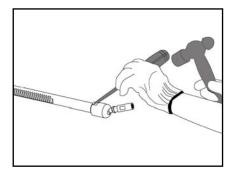


NOTICE: The tape, once removed, will be a destroyed, and should be replaced with a new one.



2. Disassemble:

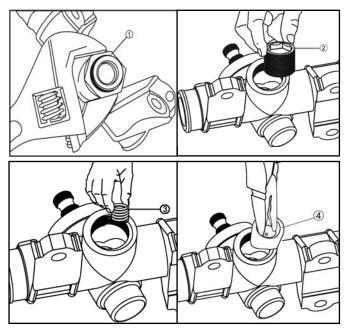
· Dust boot of steering gear



3. Disassemble:

- · Thrust washer
- · Drawbar of steering gear





EMPHASES:

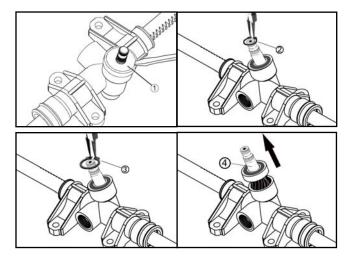
Observe whether there is a skewed slot on one side of the rack of steering gear. This skewed slot is designed to prevent the drawbar of steering gear from loosening. To re-install it, the thrust washer should be fixed in the skewed slot.

- 4. Disassemble:
 - Locknut (1)
 - Adjusting cover ②
 - Spring ③
 - · Pressing block 4



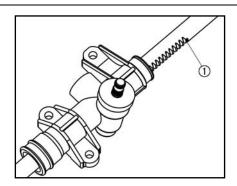
Seize and pull out the pressing block with nipper pliers, which can make the disassembly easier.

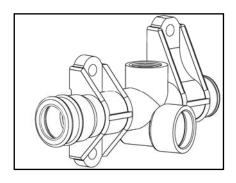
- 5. Disassemble:
 - · Oil seal ①
 - · Inner clasp ②
 - · Outer clasp ③
 - · Pinion shaft 4

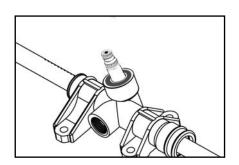


NOTICE: The oil seal, once removed, must be replaced with new one. Turn the pinion shaft with hand to inspect the operation of the bearing. In case of unsmooth operation, the bearing should be replaced.









- 6. Disassemble:
 - · Rack of steering gear ①
- 7. Inspect:
 - · Steering gear bush
 - · Deep groove ball bearing

NOTICE:

We do not recommend the replacement of worn parts in the steering gear individually. To ensure sound operating performance, we usually recommend the replacement of a new steering gear assembly.

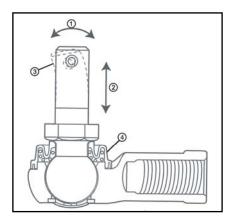
· Whether the operation of rack is smooth.

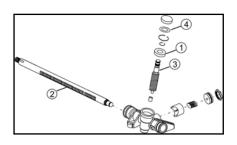
NOTICE:

Improper adjustment or lack of lubrication of the gear teeth may result in irregular abrasion.

Whether the dust boot has ruptures or scrapes







- Whether the ball joint has the following symptom:
 - Unsmooth operation ①
- Over-loose free gap ②
- Bending or deformation ③
- Damage of dust boot 4

NOTICE:

In case of any of the above condition, replace with a new ball joint.

Install:

Note the following:

- 1. Lubricate:
- Bearing ①
- · Rack ②
- Pinion shaft ③
- · Oil seal 4

Apply a thin layer of grease

Install:

 In the reverse order of the removal procedures. Refer to the schematic diagram of system parts.

Adjust the tightening torque of the cover:

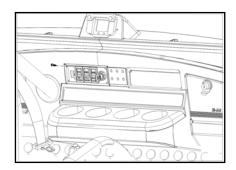
1.5-2 N · m (1.1ft·1b-1.48ft·1b)

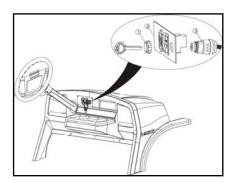
NOTICE: The steering gear should have no clamping stagnation when the left and right racks turn to the final positions. When they return to the middle position, the free gap of the steering wheel should be 45mm, or else the steering gear assembly must be replaced.

Adjust the tightening torque of locknut:

35N·m (25.8ft·1b)









/ WARNING

• Please refer to Chapter 1 "Protection for Electrical Safety".

Key switch removal

1. Turn Tow/Run switch to TOW.

Please refer to Chapter 1 "Protection for Electrical Safety".

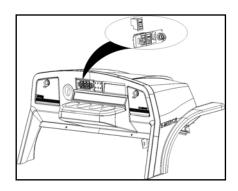
- 2. Take out the key from the key switch.
- 3. Apply the parking brake.
- 4. Remove the middle electrical regaining plate.
- 5. Pull out the instrument panel slowly (Note: do not pull apart the connecting wire of the instrument panel), pull out the wire of the key switch until the plug-in package connecting the key switch wire to the main cable appears, disengage the plug-in package of the key switch wire from that of the main cable.
- 6. Hold the key switch and remove the switch lock nut from outboard of instrument panel.
- 7. Check。

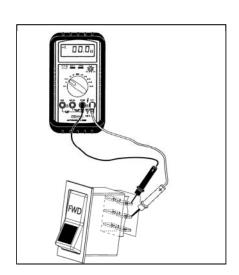
Refer to "Check Procedure 6—Circuit check for key switch and accelerator pedal switch" of Chapter 10, replace the part in case of any inconsistency.

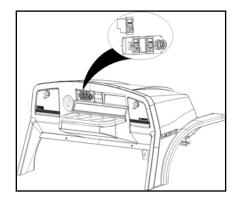
Key switch installation

Back to the removal steps









Removal of forward/reverse gear switch

1. Turn Tow/Run switch to TOW

Please refer to Chapter 1 "Protection for Electrical Safety".

- 2. Take out the key from the key switch.
- 3. Apply the parking brake.
- 4. Remove the middle electrical regaining plate.
- 5. Remove the connecting wire from gear switch.
- Press the snap locks on the upper and lower ends of the switch, push switch out of the housing.
- 7. Check:

Continuity of the gear switch.

Refer to "Check Procedure 10—forward/reverse gear switch" of Chapter 10, replace the part in case of counter conditions.

Installation of forward/reverse gear switch

Back to the removal steps

NOTE:

The red, black/yellow and blue/white wires must be connected correctly at relevant positions on the gear switch.

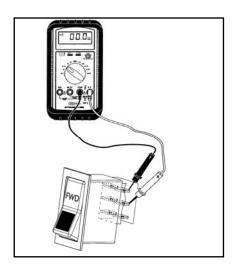
removal of headlight power switch

1. Turn Tow/Run switch to TOW

Please refer to Chapter 1 "Protection for Electrical Safety".

- 2. Take out the key from the key switch.
- 3. Apply the parking brake..
- 4. Remove the middle electrical regaining plate.

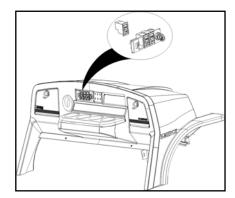




- 5. Remove the connecting wire from emergency switch.
- 6. Press the snap locks on the upper and lower ends of the switch, push switch out of the housing.

check

Continuity of the emergency switch

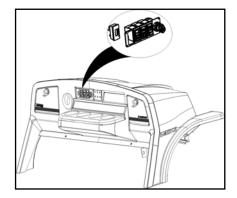


Installation of emergency switch

Back to the removal steps

Note

The red, black/yellow and blue/white wires must be connected correctly at relevant positions on the emergency switch



Installation of Battery power level indicator

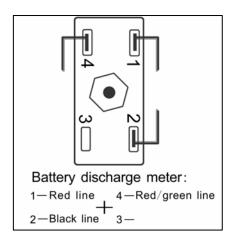




Check:

Refer to "Check Procedure 12 -- Battery discharge meter" in Chapter 10

- 1. Take out the key from the key switch.
- 2. Apply the parking brake.
- 3. Turn Tow/Run switch to TOW.



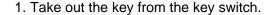
Battery discharge meter installation

Back to the removal steps

NOTE:

The red, red/green and black wires must be connected correctly at relevant positions on the battery discharge meter.



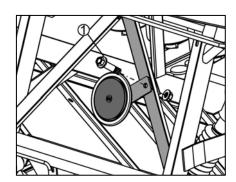


- 2. Apply the parking brake.
- 3. Turn Tow/Run switch to TOW.

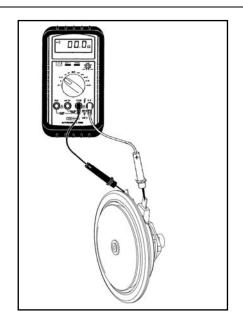
Please refer to Chapter 1 "Protection for Electrical Safety".

- 4. Disconnect the horn wire.
- 5. Remove the horn set bolt ① and remove the horn.
- 6. Check the horn for continuity.

Replace the part in case of un-continuity.







Horn installation

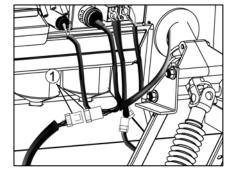
Return to disassembling steps

NOTE:

The horn wire must be connected correctly.

The tightening torque of the horn set bolt is:

9N • m (6.6ft • 1b)

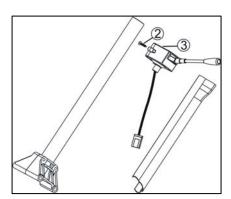


Combination switch removal

- 1. Take out the key from the key switch.
 - 2. Apply the parking brake.
 - 3. Turn Switch Tow/Run to TOW.

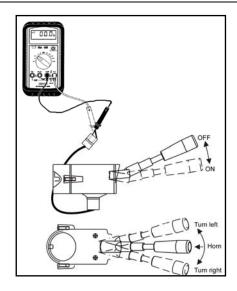
Please refer to Chapter 1 "Protection for Electrical Safety".

- 4. Remove the protective sleeve for the wire harnesses of combination switch.
- 5. Remove the set bolt ② from the top of the switch.
- 6. Remove the instrument panel; refer to the relevant contents in Chapter 4.
- 7. Disconnect the wire plug-in package ① of the combination switch and remove the combination switch ③.





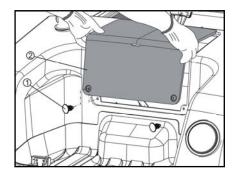


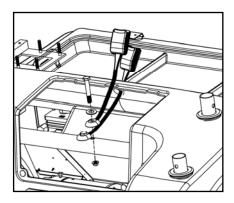


8. Turn the switch lever and check the relevant gears for continuity, replace the part in case of un-continuity.

Combination switch installation

Back to disassembling steps





Controller removal

- 1. Take out the key from the key switch.
- 2. Apply the parking brake.
- 3. Turn Switch Tow/Run to TOW.

Please refer to Chapter 1 "Protection for Electrical Safety".

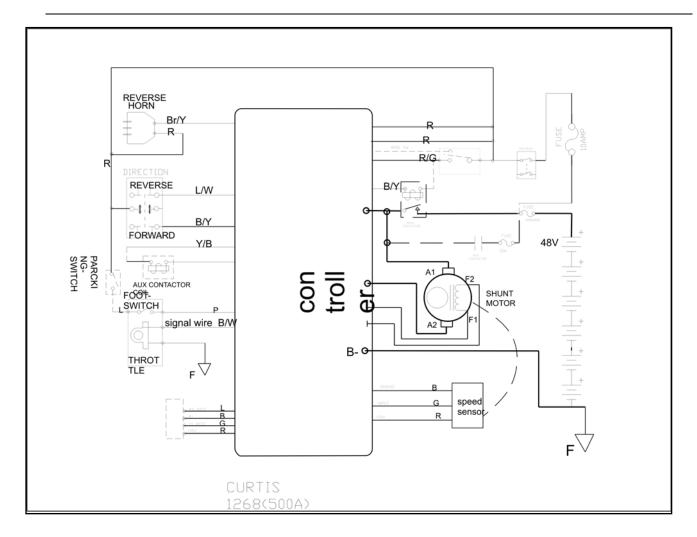
- 4. Remove the trunk lid.
- 5. Remove the rear plate plastic screw.
- 6. Remove the rear plate.
- 7. Remove the safety belt buckle set bolt

Tightening torque

63N • m(46.5ft • 1b)

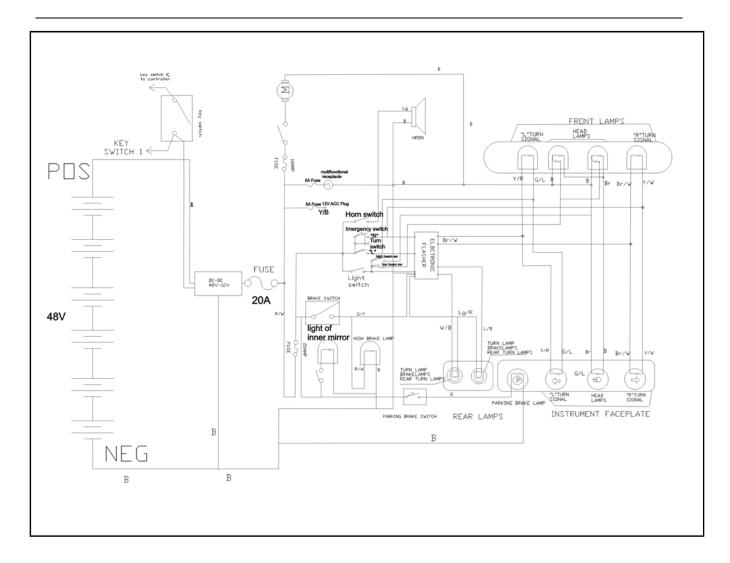
- 8. Remove the safety belt buckle
- 9. Disconnect all wires and multi-wire connectors from the controller.



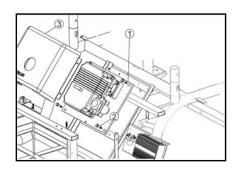


Control circuit





Lighting circuit



10. Unscrew the 4 screws on the controller mount and remove the controller.

Controller installation

Back to the removal steps.

Check the electric vehicle for normal operation:

- When Forward/Reverse gear switch is on FORWARD position, make sure the electric vehicle is running forward.
- When Forward/Reverse gear switch is on REVERSE position, make sure the electric vehicle is running backward. When

Electric Component



Forward/Reverse gear switch is on REVERSE position, the reverse buzzer should sound a warning tone.

 When Forward/Reverse gear switch is on NEUTRAL position, make sure the electric vehicle remains still.

Charger receptacle removal

- 1. Take out the key from the key switch.
- 2. Apply the parking brake.
- 3. Disconnect the battery cable according to the directions.

Please refer to Chapter 1 "Protection for Electrical Safety".

- Remove the red wire and the black wire from the positive binding post on the rear of charger receptacle.
- Screw off the 4 screws fixing the charger receptacle plate to the socket bottom and the car body.
- 6. Remove the charger receptacle retaining plate and charger receptacle.



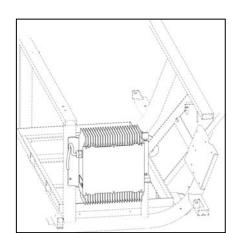
Check the receptacle for cracks, poor contact and wear and replace the part if necessary.

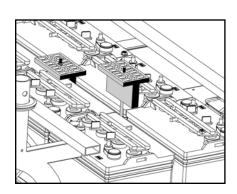
Charger receptacle installation

Back to the removal steps

Battery removal

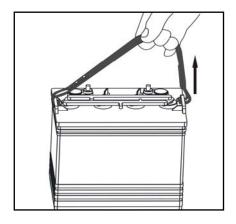
- 1. Take out the key from the key switch.
- 2. Apply the parking brake.
- 3. Remove the seat pad assembly.

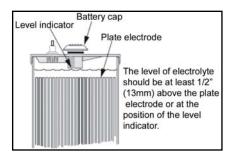


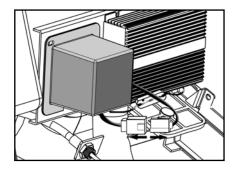


Electric Component









4. Disconnect the battery cable according to the directions.

Please refer to Chapter 1 "Protection for Electrical Safety".

- 5. Remove the nut on the battery hold down.
- 6. Remove the battery hold down
- 7. Remove the battery with a special battery lifting tool.

8. Check:

Check the electrolyte level of the battery; add distilled water to 13mm above the plate electrode if the level is below the plate electrode.

Battery installation

Back to the removal steps

NOTE:

The battery must be removed with a special battery lifting tool.

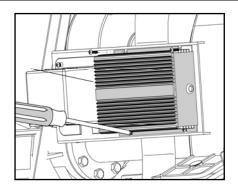
DC converter removal

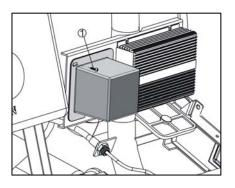
- 1. Take out the key from the key switch.
- 2. Apply the parking brake.
- 3. Remove the seat pad assembly.
- 4. Turn Tow/Run switch to TOW.

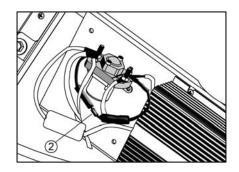
Please refer to Chapter 1 "Protection for Electrical Safety".

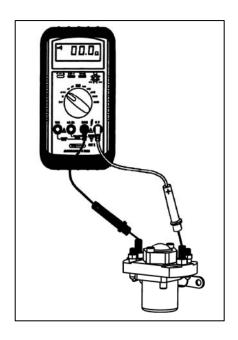
- Disconnect the wire plug-in package of DC converter.
- 6. Remove the four set bolts.











7. Remove the DC converter.

DC converter installation

Back to the removal steps.

Removal of DC changeover contactor and diode assembly

- 1. Take out the key from the key switch.
- 2. Apply the parking brake.
- 3. Remove the seat pad assembly
- Turn Tow/Run switch to TOW.

 Please refer to Chapter 1 "Protection for.
 - Please refer to Chapter 1 "Protection for Electrical Safety".
- 5. Remove the watertight cover of DC changeover contactor ①.
- 6. Remove the lock nut on the binding post of changeover contactor.
- 7. Remove the connecting wire, then remove the diode assembly ②.

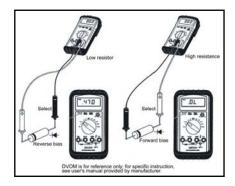
NOTE:

Keep in mind the polarity of the diode to prevent incorrect installation resulting in short circuit and electric element burning out;

- 8. Remove the DC changeover contactor.
- 9. Check:
 - The continuity of DC changeover contactor coil.
 Replace the part in case of un-continuity.
 - The continuity of diode assembly.

Replace the part in case of abnormality.





Installation of DC changeover contactor and diode assembly

Back to the removal steps.

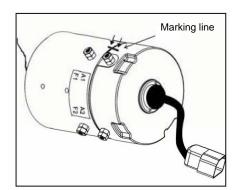
NOTE:

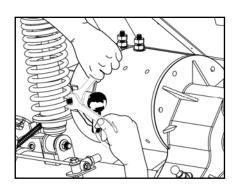
The diode must be installed with a correct polarity.

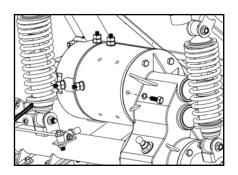
Motor removal

Safety".

- 1. Take out the key from the key switch.
- 2. Apply the parking brake.
- Turn Tow/Run switch to TOW.Please refer to Chapter 1 "Protection for Electrical
- 4. Mark a line at the motor interface with a marking pen.



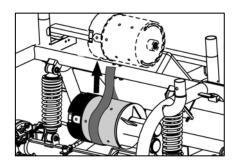


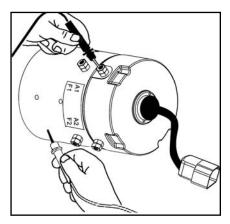


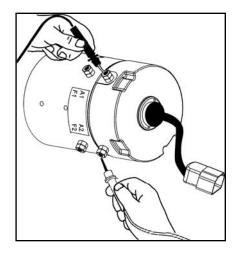
- Hold the binding post with two wrenches; disconnect the wire from the connecting terminal of the motor.
- 6. Remove the 6 bolts fixing the motor.

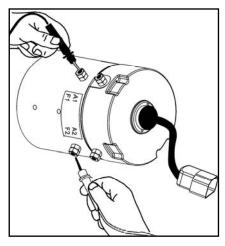
Electric Component











7. Wrap the motor at the mid position with a wide band, lift the motor carefully and move it to the left horizontally, then place it on the ground gently.

NOTE:

The motor is heavy, lift and place with care.

8. Check:

• Inside short circuit

Use a multi meter set to 200Ω , connect the black probe (-) to the motor case. Scrape off the paint to ensure a good contact. Connect the red probe (+) to terminals A1, A2, F1 and F2 respectively. The multi meter should show no connection.

Armature circuit opening

Use a multi meter set to 200Ω , connect the red probe (+) to A1 and connect the black probe (-) to A2. The multi meter should show connection.

• Exciting circuit opening

Use a multi meter set to 200Ω , connect the red probe (+) to F1 and connect the black probe (-) to F2. The multi meter should show connection.

In case of above reading errors, have the motor repaired by a professional.

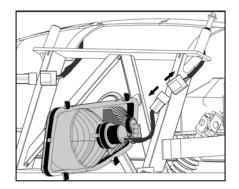


Motor installation

Back to the removal steps.

NOTE:

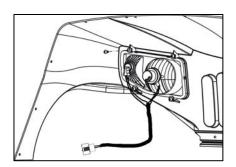
Match the marking line during motor installation.



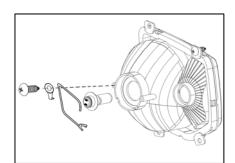
Removal of bulb of headlight and front turn signal light

- 1. Take out the key from the key switch.
- 2. Apply the parking brake.
- 3. Turn Tow/Run switch to TOW.

Please refer to Chapter 1 "Protection for Electrical Safety".



- 4. Disconnect the connecting wire of the headlight and the cable plug-in package;
- 5. Remove the 4 screws fixing the headlight with a Philips driver;
- Remove the headlight; pull apart the power cord from the headlight bulb;



- 7. Remove the 2 screws fixing the bulb with a screw driver and take out the headlight bulb;
- 8. Turn the lamp receptacle of the front turn signal light and remove the turn signal lamp bulb;
- Check the bulbs of the headlight and the turn signal lamp for continuity and replace the part in case of un-continuity.

Headlight installation



Back to the above operation steps

NOTE:

Wiring of positive/negative poles of the bulb, wiring position of high/low beam.

Tail light removal

Any defective or dim tail light shall be replaced.

- 1. Take out the key from the key switch.
- 2. Apply the parking brake.
- 3. Turn Tow/Run switch to TOW.

Please refer to Chapter 1 "Protection for Electrical Safety".

4. Remove the tail light with a flat head screwdriver.

CAUTION:

Don't break the 4 snaps on the lens; the tail light must be replaced if any of them is broken.

5. Disconnect the wire.

Tail light installation

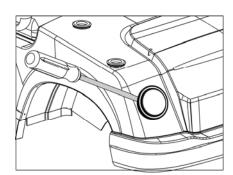
Back to removal steps

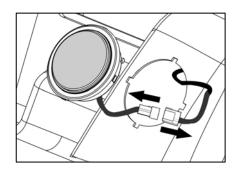
High mount stop lamp removal

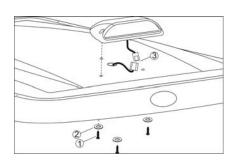
- 1. Take out the key from the key switch.
- 2. Apply the parking brake.
- 3. Turn Tow/Run switch to TOW.

Please refer to Chapter 1 "Protection for Electrical Safety".

4. Remove the screw with a screwdriver ①②.





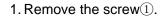






5. Disconnect the connector of the high mount stop lamp③.

High mount stop lamp disassembly



- 2. Rotate the lamp receptacle; remove the wire harness with the bulb2.
- 3. Check the continuity,

Replace the bulb assembly with wire harness in case of un-continuity②.

High mount stop lamp installation

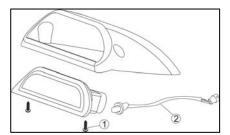
Back to removal steps

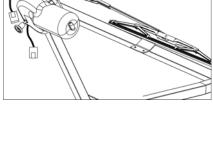
Wiper removal

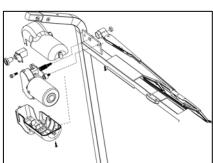
- 1. Take out the key from the key switch.
- 2. Apply the parking brake.
- 3. Turn Tow/Run switch to TOW.

Please refer to Chapter 1 "Protection for Electrical Safety".

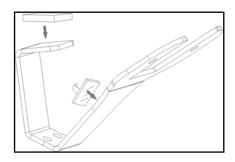
- 4. Disconnect the wiper.
- 5. Remove the wiper arm.
- 6. Remove the fixing nut of wiper motor.

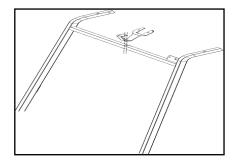


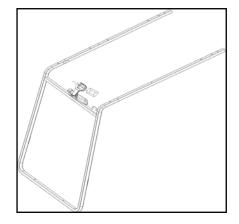


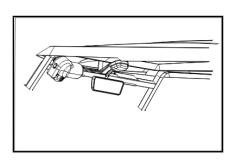












Removal of inner mirror

- 1. Take out the key from the key switch.
- 2. Apply the parking brake
- 3. Turn Tow/Run switch to TOW.
- 4. Take off the connector of inner mirror
- 5. Take off fixed nut of inner mirror
- 6. Take out the mirror

Installation of inner mirror

- Stick the sponge glue and clip on the bracket of inner mirror
- 2. Fix the bracket on windshield frame

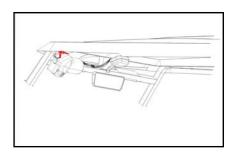
3. Take off white lense

4. Fix the mirror on the bracket



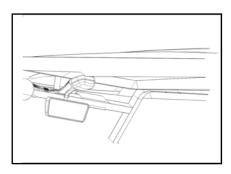
Electric Component

Chapter 9



5 Cover the light with white lense.

6.fix the wire clip on the windshield frame along left side of it.



7.connect the connector(connect one side of the two output of connector of inner mirror with wire, the other side with the output wire of wiper

8. fix the wires of inner mirror along the wire clip



Troubleshooting Chapter 10

Troubleshooting Instructions Part 1

Symptom	Possible causes	Correction action	
	Battery - dead	Charge the battery.	
		Check the wiring of the electric vehicle. Refer to the	
	Battery - battery wiring	wiring diagram on page 9-7.	
	Circuit of key switch and	Check the wire of key switch and accelerator switch	
	accelerator switch	for poor contact and disconnection.	
	Key switch failure	Refer to "Check Procedure 6—Circuit of key switch and accelerator pedal switch".	
	Accelerator pedal switch failure	Page 10-6, "Check Procedure 6—Circuit of key switch and accelerator pedal switch". Refer to "Check Procedure 2Accelerator signal voltage".	
The electric vehicle	Forward/reverse gear switch	Page 10-11, "Check Procedure 10—forward/reverse gear switch".	
can't be started	Controller overheated	Before restarting, cool the controller and make sure the electric vehicle is not overloaded.	
	Controller plug	Check the controller plug for poor contact and broken wire. Refer to "Check Procedure 7Controller signal".	
	High pedal check	Drive in correct way	
	Motor failure	Chapter 12 "Motor"	
	Controller failure	Replace controller. Refer to "Controller removal" in Chapter 9.	
	Speed sensor disconnection or failure	Page 10, "Check Procedure 9—Motor speed sensor".	
	Wrong speed setting	The set max. speed of the electric vehicle can only be changed by PC programming.	
	Circuit – incorrect wiring	Check the wiring of the electric vehicle. Refer to the wiring diagram on page 9-7.	
	Battery - dead	Charge the battery.	
	Accelerator failure	Refer to "Check Procedure 2Accelerator signal voltage"	
Floring or birth	Motorpoor contact of wire.	Check and fasten all connectors of the motor.	
Electric vehicle runs slowly	Motor failure	Replacement motor. Refer to "Motor removal" in Chapter 9.	
	Controller failure	Replace controller. Refer to "Controller removal" in Chapter 9.	
	Brake – improperly adjusted		
	Under inflated or flat tire	Refer to relevant maintenance and repair instructions.	
	Electric vehicle overload	Remove the load, make sure the electric vehicle is not overloaded.	



Troubleshooting Chapter 10

Part 1 of Troubleshooting Instructions, continue			
Symptom	Possible causes	Correction action	
The electric vehicle	Circuit – incorrect wiring	Check the wiring of the electric vehicle. Refer to	
can be started, but the		the wiring diagram on page 9-7.	
motor braking device	Speed sensor disconnection or	Refer to "Check Procedure 9—Motor speed	
does not operate.	failure	sensor".	
Electric vehicle can	Forward/reverse gear switch—incorrectly connected or damaged.	Refer to, "Check Procedure 10—forward/reverse gear switch".	
only run forward or backward.	Motor – incorrect wiring.	Check the wiring of the motor. Refer to the wiring diagram on page 9-7.	
	Controller—incorrect wiring or	Check the wiring of the electric vehicle. Refer to	
	controller piece failure.	the wiring diagram on page 9-7.	
The electric vehicle can be started, but the	Battery charger connection—wire poor contact of the receptacle or battery.	Check the wire for connection and fasten it when necessary.	
battery charger can't charge the battery.	Battery charger	Refer to relevant maintenance and repair instructions for battery charger.	
	DC converter failure	Replace DC converter	
	Lighting fuse blowing out	Replace fuse	
Headlight failure	Auxiliary contactor failure	Replace contactor	
	Bulb damaged	Replace bulb	
	Combination switch failure	Replace combination switch	
	DC converter failure	Replace DC converter	
Turn signal lamp	Turn signal lamp bulb	Replace bulb	
failure	Flasher failure	Replace flasher	
	Combination switch failure	Replace combination switch	
	DC converter failure	Replace DC converter	
	Lighting fuse blowing out	Replace fuse	
Toil light foilure	Auxiliary contactor failure	Replacement contactor	
Tail light failure	Tail light damaged	Replace tail light	
	Flasher failure	Replace flasher	
	Combination switch failure	Replace combination switch	
	DC converter failure	Replace DC converter	
High mount stop lamp	Flasher failure	Replace flasher	
failure	Brake switch failure	Replace brake switch	
	High mount stop lamp bulb damaged	Replace high mount stop lamp bulb	
	Odometer parking lamp bulb failure	Replace odometer parking lamp bulb	
Parking lamp failure	Parking switch failure	Replace switch	
	Bulb damaged	Replace bulb	



Check procedures

With the following procedures, the entire electrical system can be checked without disassembling the electric vehicle.

/ WARNING

• If the wires are removed or replaced, make sure that the wires and harnesses are arranged and fixed correctly. Wires and harnesses not arranged and fixed correctly can result in electric vehicle failure, property damage and casualties.

Index for check procedures

- 1. Battery/ voltage check
- 2. Accelerator signal voltage
- 3. Motor voltage at A1 and A2
- 4. TOW/RUN switch
- 5. Battery voltage (under voltage)
- 6. Circuit of key switch and accelerator pedal switch
- 7. Controller signal
- 8. Charger
- 9. Motor speed sensor
- 10. Forward/reverse gear switch
- 11. Backing buzzer
- 12. Battery discharge meter
- 13. High mount stop lamp
- 14. Wiper
- 15. Flashing light



Check Procedure 1—Battery / voltage check

NOTE: to perform the following check procedures, the battery should be maintained properly and charged fully.

Use a DC multimeter set to 200V, connect the black (-) probe to the negative output binding post of the battery and connect the red (+) probe to the positive wire of the battery.

Check Procedure 2--Accelerator signal voltage

Please refer to Chapter 1 Protection for Electrical Safety.

- 1. Use a DC multimeter set to 20V, connect the black (-) probe to the negative binding post of the battery and connect the red (+) probe to Wire 7 (black/white wire). The reading should be around 0V at the original position of the pedal. Press down the accelerator pedal slowly; observe the reading on the multimeter. When the pedal is pressed, the reading should be increased by 0V-5V until the pedal is pressed down completely.
- 2. If the reading is not increased while pressing the pedal, the accelerator should be replaced.
- 3. If the reading is lower than 4.5V when the pedal is pressed down completely, the electric vehicle can not run at the rated max speed. Please check whether the accelerator is in good condition.

Check Procedure 3-- Motor voltage at A1 and A2

Please refer to Chapter 1 "Protection for Electrical Safety".

- 1. Jack up the rear axle of the electric vehicle so that the rear wheels are in the air.
- 2. Check that the battery is wired correctly, then connect the black (-) probe of a multimeter set at 200V DC to motor terminal A2 and connect the red probe (+) to motor terminal A1.
- 3. With TOW/RUN switch on position RUN, turn the Switch Forward/Reverse to FORWARD, then press the accelerator pedal slowly.
- 4. While the accelerator pedal is pressed, the voltage reading should be increased from 5V when the accelerator pedal switch is closed to 48V when the accelerator pedal is pressed down completely.
 - 4.1 If no voltage reading is displayed, check the accelerator. Refer to "Check Procedure 2--Accelerator voltage".
 - 4.2 Disconnect the battery cable according to the directions. Please refer to Chapter 1 "Protection for Electrical Safety".
 - 4.3 Check the continuity of motor binding posts A1, A2 and F1, F2. In addition, check all motor wires for continuity. Refer to "Motor" in Chapter 12.



Check Procedure 4 - TOW/RUN switch

Please refer to Chapter 1 "Protection for Electrical Safety".

- 1. Use a multimeter, set it at diode testing position, connect the black (-) probe to one connecting terminal of towing switch and put the red (+) probe on the connecting terminal on the other side.
- 2. When TOW/RUN switch is on position RUN, the multimeter should show a conducting state. When TOW/RUN switch is on position TOW, the multimeter should show a disconnect state.
- 3. Check the continuity of the other group terminals with the above mentioned method.
- 4. If the continuity reading is not correct, replace the TOW/RUN switch.

Check Procedure 5—Battery voltage

Please refer to Chapter 1 "Protection for Electrical Safety".

- 1. Before starting this check procedure, connect the battery properly and charge it fully. Use a 48V battery discharger. Connect the positive electrode (+) wire to the positive binding post of Battery 1 and connect the negative electrode (-) wire to the negative binding post of Battery 6. Write down the voltage reading of the discharger.
- 2. Turn on the discharger and record the voltage reading of the battery at under voltage.
- 3. For a fully charged battery in good condition, the reading should be lower than 41 at under voltage.
- 4. A reading of 41V indicates a discharged or faulty battery. Each battery should be checked in under voltage state with a multimeter.
- 5. Don't start the discharger if the voltage is lower than 41V. If the battery voltage is lower than 41V, it indicates the battery is completely discharged or faulty.
- 6. Record the voltage reading of the battery pack in under voltage state allows a more accurate diagnosis on battery condition. When the discharger is started, it will result in battery pack under voltage, repeated operations are helpful to determine the failure of one or more batteries in the battery pack. The voltage of the battery not measured at under load may not show the actual condition of the battery. For more information on battery, refer to Chapter 11 "Battery and Charger".

Check Procedure 6—Circuit check for key switch and accelerator pedal switch

- 1. Disconnect the battery cable according to the directions. Please refer to Chapter 1 "Protection for Electrical Safety".
- 2. Check the key switch.
- 3. Remove the middle instrument panel. Refer to "Key switch removal" in Chapter 9.
- 4. Use a multimeter set at 200Ω ; connect the red (+) probe to the key switch terminal connected with a red wire. Connect the black (-) probe to the other terminal of the key switch.

Troubleshooting

Chapter 10

- 5. When the key switch is on position OFF, the multimeter should show an open circuit condition.
- 6. When the key switch is on position ON, the multimeter should show a conducting state.
- 7. If other readings are obtained, replace the key switch. Refer to "Key switch removal" in Chapter 9.
- 8. If the key switch operates as above, install the instrument panel in the reverse sequence of removal and perform the following operations.
- 9. Check accelerator pedal switch.

NOTE: Before operation, make sure the key switch operates properly and the key switch and the instrument panel are installed correctly.

- 9.1 When the battery is connected, use a multimeter set at 200V DC, connect the black (-) probe to the negative binding post of Battery 6 and connect the red (+) probe to the pedal switch output wire (Wire 3).
- 9.2 When the Tow/Run switch is on RUN position, the key switch is ON and Forward/Reverse gear switch is on NEUTRAL, the voltage reading should be 0V. When the accelerator pedal is depressed, the voltage reading should be reference voltage (48V, the battery should be fully charged).
- 9.3 If the voltage reading is 0V when the accelerator pedal is depressed, check the pedal switch circuit in the following procedures.
 - 9.3.1 Use a multimeter set at 200V DC, connect the black (-) probe to the negative binding post of Battery 6 and connect the red (+) probe to the pedal switch output wire (Wire 1). Turn on the key switch, the reading should be around 48V (the battery is fully charged).
 - 9.3.2 If the reading is 0V, check the red wire between the key switch and the accelerator for continuity, if it is ok, check the accelerator pedal switch for continuity. If the continuity of pedal switch is checked with an unsatisfactory result, replace the accelerator.

Troubleshooting

Check Procedure 7--Controller signal

9-wire connector of controller plug	Function
(Pin 1)-red wire	Battery - positive electrode
(Dip 2) vollow wire	Input signal of motor speed sensor - a pulse input signal
(Pin 2)- yellow wire	provided to controller by motor speed sensor.
	FORWARD input signal provided by Forward/Reverse
(Pin 4) - black/yellow wire	switchwhen Forward/Reverse switch is on FORWARD
(Fill 4) - black yellow wife	position, the switch provides a voltage of +48V to the
	controller.
	REVERSE input signal provided by Forward/Reverse
(Pin 5) - blue/white wire	switchwhen Forward/Reverse switch is on REVERSE
(Fill 3) - blue/writte wife	position, the switch provides a voltage of +48V to the
	controller.
(Pin 7) - black/white wire	An input signal of 0-4.6V provided to the controller by
(1 III 7) - black write wife	accelerator
(Pin 6) - red/green wire	Key switch input signalwhen the key switch is ON, the switch
(1 iii 0) - rea/green wire	provides a voltage of +48V to the controller.
	Pedal switch – when the accelerator pedal is depressed, the
(Pin 3)-pink wire	accelerator limit switch provide a voltage of +48V to the
	controller.
(Pin 10) brown/vollow wire	Buzzer output signal - output signal provided to reverse
(Pin 10) - brown/yellow wire	buzzer by controller.
(Pin 14)-light green wire	Mode switch signal, provide two types of mode conversion

Check Procedure 7A—Pin 1

- 1. Use a multimeter set at 200V DC, insert the red (+) probe of the multimeter into Pin 1 (red wire). Refer to the following Note. Connect the black (-) probe to the negative binding post of the battery pack.
- 2. Turn Tow/Run switch to RUN, then the multimeter should display a full battery voltage (about 48V).
- 3. If another reading is displayed, the following items must be checked:
 - · Continuity of wires in harness;
 - Check whether Tow/Run switch operates normally. Refer to "Check Procedure 4 TOW/RUN switch"

Δ NOTE:

• Never insert the complete probe into the 9-wire plug for fear of poor contact.



Check Procedure 7B—Pin 4 and 5

Please refer to Chapter 1 "Protection for Electrical Safety".

Pin 4 and 5 of the 9-wire connector are designed to connect Forward/Reverse switch and the controller. When Forward/Reverse switch is on FORWARD position, the switch sends a +48V signal to the controller through Pin 4; when Forward/Reverse switch is on REVERSE position, the switch sends a +48V signal to the controller through Pin 5.

1. Use a multimeter set at 200V DC, insert the red (+) probe of the multimeter into Pin 4 (black/yellow wire). Refer to the following Note. Connect the black (-) probe to the negative binding post of the battery pack.

Δ Note:

- Never insert the complete probe into the 9-wire plug for fear of poor contact.
- 2. When Tow /Run switch is turned on RUN and Forward/Reverse switch is on NEUTRAL, the multimeter should display a 0V DC voltage.
- 3. While observing the multimeter, turn the Forward/Reverse switch to REVERSE. The multimeter should display a voltage of +48V.
- 4. Turn Forward/Reverse switch to FORWARD, the multimeter should display a full battery voltage (about 48V).
- 5. Insert the red (+) probe of the multimeter into Pin 5 (blue/black wire) of the 9-wire connector. Leave the black (-) probe connected to the negative binding post of the battery pack. Refer to the above Note.
- 6. Turn the Forward/Reverse switch to NEUTRAL. Now, the multimeter should display a 0V DC voltage.
- 7. While observing the multimeter, turn Forward/Reverse switch to FORWARD, the multimeter should display a voltage of +48V.
- 8. Turn Forward/Reverse switch to REVERSE, the multimeter should display a full battery voltage (about 48V).
- 9. If another reading is displayed, the following items must be checked:
 - · Continuity of wires in harness;
 - Whether Forward/Reverse switch operates normally. Refer to "Check Procedure 10—Forward/Reverse gear switch".
 - Check whether Tow/Run switch operates normally. Refer to "Check Procedure 4 TOW/RUN switch".



Check Procedure 7C—Pin 7

1. Use a multimeter set at 200V DC, insert the red (+) probe of the multimeter into Pin 7 (pink wire). Refer to the following Note. Connect the black (-) probe to the negative binding post of the battery pack.

Δ Note:

- Never insert the complete probe into the 9-wire plug for fear of poor contact.
- 2. When Tow/Run switch is turned on RUN and Forward/Reverse switch is on NEUTRAL, the multimeter should display a 0V DC voltage.
- 3. Depress the accelerator pedal slowly, the multimeter voltage should change from 0V to 4.6-5V.
- 4. If multimeter voltage does not change, the following items must be checked:
 - 4.1 Continuity of wires in harness;
 - 4.2 If the continuity is ok, please check whether the handle brake switch is connected and the wire connection is correct, if it is abnormal replace the accelerator.

Check Procedure 7D—Pin 6

- 1. Use a multimeter set at 200V DC, insert the red (+) probe of the multimeter into Pin 6 (red/green wire). Refer to the following Note. Connect the black (-) probe to the negative binding post of the battery pack.
- 2. With key switch turned ON, turn Tow/Run switch to RUN, then the multimeter should display a full battery voltage (about 48V).

Δ NOTE:

- Never insert the complete probe into the 9-wire plug for fear of poor contact.
- 3. If another reading is displayed, the following items must be checked:
 - · Continuity of wires in harness;
 - Check whether the key switch operates normally;
 - Check whether Tow/Run switch operates normally. Refer to "Check Procedure 4 TOW/RUN switch" on page 25.

Check Procedure 7E—Pin 3

1. Use a multimeter set at 200V DC, insert the red (+) probe of the multimeter into Pin 3 (magenta wire). Refer to the following Note. Connect the black (-) probe to the negative binding post of the battery pack.



Δ Note:

- Never insert the complete probe into the 9-wire plug for fear of poor contact.
- 2. When Tow/Run switch is turned on RUN and Forward/Reverse switch is on NEUTRAL, the multimeter should display a 0V DC voltage.
- 3. Depress the accelerator pedal, the multimeter should display the full battery voltage (about 48V).
- 4. If multimeter voltage does not change, the following items must be checked:
 - · Continuity of wires in harness;
 - If the continuity is ok, replace the accelerator pedal switch. Refer to "Check Procedure 6—Circuit check for key switch and accelerator pedal switch".

Check Procedure 8—Motor speed sensor

Please refer to Chapter 1 "Protection for Electrical Safety".

Δ NOTE:

- The following operations must be conducted on a flat surface. To prevent injury or property loss, make sure that the passage of the electric vehicle is unblocked before moving it.
 - 1. Turn the key switch to OFF and turn Forward/Reverse gear switch to NEUTRAL.
 - 2. Use a multimeter set to 200V DC, connect the red (+) probe to the positive binding post of the battery and connect the black (-) probe to the Terminal 16 of the 3-wire connector. The voltage reading should be approximately 0V (the battery is fully charged).
 - 3. Turn Tow/Run switch to RUN, use a multimeter set to 20V DC, connect the black (-) probe to the negative binding post of the battery pack and connect the red (+) probe to red wire of the 3-wire connector. The voltage reading should be approximately 12V.
 - 4. If the reading is 0V, check the continuity of red wire of 3-wire connector which connects the controller and the motor speed sensor. If the continuity is ok, replace the controller.
 - 5. If the voltage reading is correct, continue with the following operations:
 - 5.1 Use a multimeter set to 20V DC, connect the black (-) probe to the negative binding post of the battery pack and connect the red (+) probe to the terminal of green wire of the 3-wire connector on the motor speed sensor. The voltage reading should be approximately 4.60-5.00V.
 - 5.2 If the reading is 0V, check the continuity of green wire of 3-wire connector which connects the controller and the motor speed sensor. If the continuity is ok, replace the controller.
 - 5.3 If the reading is lower than 3.50V, check the wire and plug for continuity and replace the controller if necessary.



- 6. Reconnect the 3-wire connector on the motor speed sensor. Use a multimeter set to 20V DC, connect the black (-) probe to the negative binding post of the battery pack and connect the red (+) probe to green wire which is between the 3-wire connector on the motor speed sensor.
 - 6.1 Jack up a rear wheel so that it is off the ground. Turn the rear wheel slowly drive the armature of the motor. When the armature is rotating, the voltage reading should change from 0V to approximately 4.85V. In each round the motor armature rotates, the voltage reading will change from 0V to 4.85V and 0V for 4 times.

NOTE: 4.85V is a approximate reading of voltage. The actual reading may range between 4.50V and 5.00V.

- 6.2 The speed sensor should be replaced in the following cases:
 - No voltage reading is displayed;
 - The voltage reading is no greater than 3.50V;
 - No voltage reading change when the motor is running.

Check Procedure 9—forward/reverse gear switch

Please refer to Chapter 1 "Protection for Electrical Safety".

- 1. Disconnect the battery cable according to the directions. Please refer to Chapter 1 "Protection for Electrical Safety".
- 2. Disconnect the 3 wires from the gear switch. Use a multimeter set at 200Ω,connect the black (-) probe to Position 7 (or 8) of the gear switch, then connect the red (+) probe to Position 3 (or 4). When the switch is on NEUTRAL or REVERSE, no continuity should be indicated. When the switch is on FORWARD, continuity should be indicated. If the reading is not correct, replace the switch.
- 3. Connect the black (-) probe to Position 1 (or 2) of the gear switch, then connect the red (+) probe to Position 3 (or 4). When the switch is on NEUTRAL or FORWARD, no continuity should be indicated. When the switch is on REVERSE, continuity should be indicated. If the reading is not correct, replace the switch.

Check Procedure 10—Reverse buzzer

- 1. Disconnect the battery cable according to the directions. Please refer to Chapter 1 "Protection for Electrical Safety".
- 2. Remove screws on each side of the instrument panel
- 3. Pull out the instrument panel along the driving handle.
- 4. Disconnect the brown/yellow wire and the red wire from the reverse buzzer. Make sure that the terminal on the key switch will contact the frame.



- 5. Turn Tow/Run switch to RUN.
- 6. When the battery is connected, use a multimeter set at 200V DC, connect the black (-) probe to the negative binding post of Battery 6 and connect the red (+) probe to the disconnected red terminal of the reverse buzzer. The voltage reading should be approximately 48V (the battery is fully charged).
- 7. If the voltage reading is correct, go to Step 12.
- 8. If the reading is 0, check the continuity of the red wire and Tow/Run switch. Refer to "Check Procedure 4 TOW/RUN switch".
- 9. If the continuity reading is not correct, repair or replace the red wire.
- 10. If the continuity reading is correct, continue with the following operations.
- 11. Turn Forward/Reverse gear switch to REVERSE position. Use a multimeter set to 200V DC, connect the red (+) probe to the positive binding post of Battery 1 and connect the black (-) probe to the brown/yellow wire of the output line of the buzzer. The voltage reading should be approximately 43V.
- 12. If the reading 0V, check the brown/yellow wire for continuity and the connection of Pin P10 of the 9-wire connector.
- 13. In case of un-continuity of the brown/yellow wire or improperly arranged Pin 10 of the controller, repair or replace the part as required.

Check Procedure 11 -- Battery discharge meter

Please refer to Chapter 1 "Protection for Electrical Safety".

The main cable has three wires connected to the battery discharge meter: red wire (connected to Tow/Run switch), red/green wire (connected to key switch) and black wire (connected to the negative terminal of the battery pack).

Check as follows with a multimeter:

- 1. Turn Tow/Run switch to RUN, use a multimeter set to 200V DC, connect the red (+) probe to the red wire and connect the black (-) probe to the negative binding post of Battery 6. The voltage reading should be 48V. If the voltage is 0V, check the continuity of the red wire and Tow/Run switch.
- 2. Turn Tow/Run switch to RUN and turn the key switch to ON, use a multimeter set to 200V DC, connect the red (+) probe to the red/green wire and connect the black (-) probe to the negative binding post of Battery 6. The voltage reading should be 48V. If the voltage is 0V, check the continuity of the red/green wire and key switch.
- 3. Check the continuity of the black wire and the battery pack.

If the three wires are ok and the battery discharge meter displays nothing, replace the battery discharge meter.



Check Procedure 12-- High mount stop lamp

Please refer to Chapter 1 "Protection for Electrical Safety".

With Tow/Run switch on RUN and key switch ON, check the high mount stop lamp interface on main cable with a multimeter set at 200V DC (connect the red probe to green/yellow wire and connect the black probe to black wire) while depressing the brake pedal. The voltage should be 12V. Perform the following checks if the voltage is 0:

- 1. Check whether the DC converter outputs a 12V voltage. Check the converter for failure and replace it if necessary. Continue with Step 2 if it is ok.
- 2. Check the fuse in the fuse box and replace it if necessary. If the fuse is ok, go to Step 3.
- 3. Check the brake switch for normal operation.
- 4. If everything is ok and the measured voltage is still 0, replace the main cable.

Check Procedure 13 - wiper

Please refer to Chapter 1 "Protection for Electrical Safety".

With Tow/Run switch on RUN and key switch ON, check the wire connected to the wiper of main cable with a multimeter set at 200V DC (connect the red probe to yellow/blue wire and connect the black probe to black wire). The voltage should be 12V. Perform the following checks if the voltage is 0:

- 1. Check whether the DC converter outputs a 12V voltage. Check the converter for failure and replace it if necessary. Continue with Step 2 if it is ok.
- 2. Check the fuse in the fuse box and replace it if necessary. If the fuse is ok, go to Step 3.
- 3. If no problem is found in the above Step 1 and 2 and there is no 12V output, replace the wiper harness.
- 4. If the above checks are satisfactory (ie. there is a 12V output), connect the wiper interface to the main cable and turn on the wiper switch to check the wiper for normal operation, replace the wiper if it does not operate.

Check Procedure 14— flashing light

Please refer to Chapter 1 "Protection for Electrical Safety".

With Tow/Run switch on RUN and key switch ON, check the wire connected to the flashing light of main cable with a multimeter set at 200V DC (connect the red probe to yellow/blue wire and connect the black probe to black wire). The voltage should be 12V. Perform the following checks if the voltage is 0:

- 1. Check whether the DC converter outputs a 12V voltage. Check the converter for failure and replace it if necessary. Continue with Step 2 if it is ok.
- 2. Check the fuse in the fuse box and replace it if necessary. If the fuse is ok, go to Step 3.



- 3. If no problem is found in the above Step 1 and 2 and there is no 12V output, replace the main cable.
- 4. If the above checks are satisfactory (ie. there is a 12V output), connect the flashing light interface to the main cable to check the flashing light for normal operation, replace the flashing light if it does not operate normally.

Troubleshooting Instructions Part 2 (controller failure indication code):

CURTIS1268 controller There is two methods to make diagnosis: one is hand holder programmer, have a troubleshooting the source of range through the indication code on controller; another is get the troubleshooting information from the LED indicator on the controller.

Programmer diagnosis

The programmer express full of trouble shooting information with brief work, it was showed on the manual, the input/output status was showed on the testing manual.

The history manual of diagnosis provides all the troubleshooting list after last clean of history manual, we suggest you check and clean all troubleshooting history file when you do the maintenance each time.

For example: if the car can not move forward, the way of repairing will be:

- 1. There is no failure on the cable connection, such as: disconnect or loosen
- 2. Connect the programmer, choose diagnosing manual, see the display on it, if it says: NO KNOW FAULTS then it means everything is OK
- Choose testing manual, observe the input/output status for forward, if the "FORWARD INPUT" is OFF on the testing manual, then there is some failure on the forward switch or the switch cable connection.
- 4. Check or replace the cable of forward switch. Test it again, if the programmer displays the forward switch is ON and the car is workable then it means the problem has been solved.

Controller failure indication code

NO.	LCD display on programmer	Meaning	Reasons
1	THROTTLE FAULT 1	The sliding signal of accelerator is out of range	 The input cable of the throttle is open Throttle cable is short circuit to B+ or B-
2	LOW BATTERY VOLTAGE	Low voltage in the battery	 Cut off due to lower voltage The end of battery connection is corrosive The terminal of battery or controller is loose
3	OVER VOLTAGE	Over voltage	 Cut off due to lower voltage Charge battery during it work Battery is off when you apply for brake
4	THERMAL CUTBACK	Cut off due to higher/lower temperature	 Temperature is over 85°C or less than-25°C Over loaded The installation of controller



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			is not fit
			4. The extreme work condition
			1. The order of direction and
			throttle is wrong
			2. Choose wrong HPD type
5	HPD	HPD failure	3. Wrong adjustment on the
			throttle potentiometer
			4. Order delay is too short
			1 wrong connection on the
6	RELAY COIL FAULT	Time-delay coil failure	time-delay coil
		Time-delay coil over	1. short circuit on the time-delay
7	RELAY DRIVER OFF	currency	coil
		Time-delay coil less	1 time-delay coil is off or
8	RELAY DRIVER ON	currency	damaged
			1、Fuse is broken
9	CIRCUIT BRKR OPEN	Antislip circuit is open circuit	2、Antislip circuit failure
		or fuse is damage	3、Speed sensor failure
			1、Main contactor is welded
10	MAIN WELDED	Main contactor welded	2. The drive of main contactor
			is short
			1、Auxiliary contactor is welded
11	WELDED AUX CONT	Auxiliary contactor welded	2. The drive of auxiliary
			contactor is short
			1. No connection on the speed
12	SPEED SENSOR FAULT	Speed sensor failure	sensor
			2. Speed sensor is broken
		The drive input of main	1. Main contactor failure or
13	MAIN DRIVER ON	contactor is less currency	open circuit
		-	2、controller is broken
14	MAIN COIL FAULT	The coil of main contactor is	1. The coil of main contactor is
		failure	open or disconnect
15	MAIN DROPOUT	Main contactor is open	1、main contactor is broken
			1. incorrect installation of the
16	MOTOR STALL	Motor failure	motor
			2、Motor stall
			3、EM brake cable is fault
			Speed sensor is broken Main contactor failure or coil.
17	MAINI DDIVED OFF	Driving output on main	Main contactor failure or coil is short circuit.
	MAIN DRIVER OFF	contactor is over currency	is short circuit.
			2. Controller is broken1. the driving of auxiliary
18	AUX CONT DN	Auxiliary contactor is open	contactor is short circuit
			1. Interlock on the key switch
19	KEY SWITCH SRO	Key switch SRO failure	and the order delay is wrong
			and the older delay is wrong

_			
			2、Choose wont type of SRO
			3. Interlock or direction switch
			is open circuit
			4. Order delay is too short
20	CURRENT SENSE FAULT	Excitation currency sensor	1、controller is broken
		failure	
21	M- SHORTED	Inner M-is short circuit to B-	1、controller is broken
22	45 VOLT FALLET	15V voltage is out of range	1、Controller is broken
	15 VOLT FAULT		2、Seton of exterior circuit
23	DRIVER OVERCURRENT	Over currency on main	1 main contactor or auxiliary
	DRIVER OVERCORRENT	contactor or auxiliary one	contactor is short circuit
24		loner veltere is too low	1、Controller is broken
	PRECHARGE FAULT	Inner voltage is too low	2. Out B- is short to B+ or leak
		during start	power
25	FIELD MISSING	Evoltation domage	1、Motor field cable come off
	FIELD WISSING	Excitation damage	2、Motor field cable is open
26	HW FAILSAFE	Automatic checking failure	1、controller is broken

Picture 1, 1268 controller programmer faulty code table

二、LED failure diagnosis

There is LED on the controller, you can see it from the window on the top of controller cover. When there is any fault on the controller or the input then it will display the failure indication code. When it work, the LED will flicker steadily; if it inspect some failure, the dibit indicator will keep flickering until the trouble was eliminated. Such as if the code"3, 2" main contactor is welded, it display as below.

n n n д¤ ggg ¤¤ ggg д¤ (3,2)(3,2)(3,2)

Code list:

LED code	symbol	description
LED all off		No power or the controller was broken
All on		Problem one the micro processor in the
		controller
1,1	пп	Controller was broken
1,2	n nn	The sliding signal of accelerator is
		outside the scope



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1,3	מממ	Speed sensor failure
1,4		HPD failure
1,5	a aaaaa	Motor failure
2,1	aa a	Low voltage in the battery
2,2	ממ ממ	Over voltage
2,3	ממ מממ	Over/less temperature off
2,4	ממ ממממ	Lack of currency on the driving output in
		the main contactor
2,5	ממ ממממ	Auxiliary contactor is open
3,1	nnn n	Driving input of main contactor is over
		currency
3,2	מממ ממ	Main contactor is weled
3,3	ממם ממם	The inner voltage is too low during start
3,4	מממ ממממ	Excitation damage
3,5	מממ ממממ	Auxiliary contactor is over currency
4,1	anna a	Field currency speed sensor is failure
4,2	ממממ ממ	The driving of main contactor or auxiliary
		is over currency
4,3	מממ מממ	Inner M-is short circuit to B-
4,4	ממממ ממממ	The auxiliary is delay of close
4,5	авав вавав	Auxiliary contactor is delay of weled
5,1	авава в	Key switch SRO failure
5,2	מממממ ממ	The coil of main contactor is open
5,3	ממממ מממ	Less currency on the coil
5,4	ממממ ממממ	antislip circuit failure or antislip fuse is
		open circuit
5,5	ממממ ממממ	Main contactor is open

Picture 2. 1268 controller LED diagnosis table

Note: one time only display one failure, the failures are not in order. If there is some mistake on the SRO, you could eliminate it by converting the lock switch or key switch.



Battery

Overview

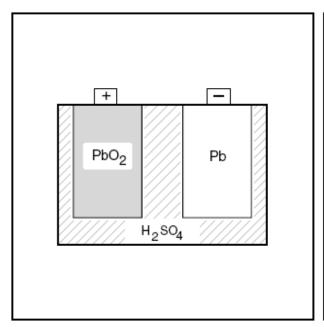
The battery provided for the electric vehicle must be able to provide all (100%) the energy it requires. Therefore, the battery will make a deep discharge of 70% to 80% of its full capacity before being recharged, which is a process named "deep cycle". Notwithstanding the great discrepancy of current intensity of different vehicles in varied operation modes, the average current intensity on the 48V electric vehicle is 75A. The deep cycle battery is specially designed for this purpose.

The chargeable lead-acid battery can translate the chemical energy into electrical energy and vice versa. The major active elements in the battery are positive plate, negative plate and electrolyte (sulfuric acid). Another important element (not active) is partition. The partition is verifiably an element that separates the positive plate and negative plate and prevents their contact. Their contact will result in the short circuit. The partition has sufficient holes to allow the passage of charged ions through positive and negative plates while preventing the contact of the plates.

Two different metals that are immersed into one acid can generate the electric current. In the deep cycle battery, the negative plate contains plum bum (Pb), and the positive plate contains lead dioxide. These plates are immersed in the sulfuric acid solution (H₂SO₄) (see Fig 11-1).

During the discharge, the chemical reaction in the battery will result in the departure of sulfate ion (SO_4) from H_2 (see Fig 11-2).

The sulfate ion (SO_4) and the plum bum (Pb) on the two plates together form lead sulfate (PbSO₄). The oxygen from the positive plate (O_2) and the hydrogen from the electrolyte (H) form water (H_2O) (see Fig 11-3).



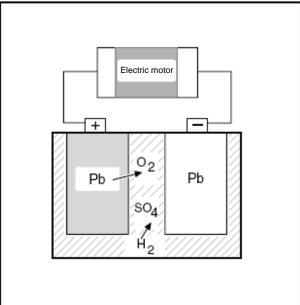


Fig 11-1: Schematic diagram of charged battery

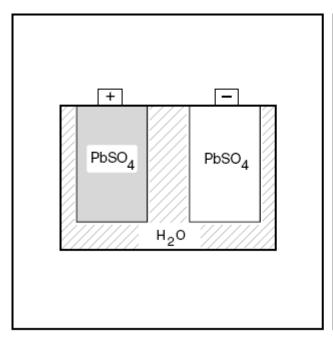
Fig 11-2: Discharging battery



The result is two metalloids, the lead sulfate (PbSO₄) immerse in water (H₂O). As the battery is fully discharged, no electric energy can be generated.

After the connection of discharged battery and the charger, in the reverse procedures, the sulfate ion (SO₄) enters the electrolyte from the positive and negative plates to form sulfuric acid (H₂SO₄). The oxygen returns to the positive plate to form lead dioxide (PbO₂) (see Fig 11-4).

The result is the chargeable battery that can re-generate the electrical energy.



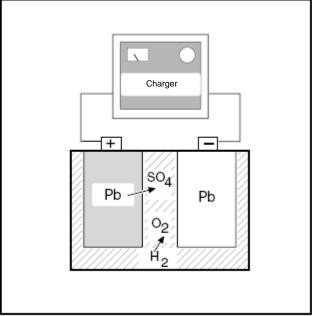


Fig 11-3: Discharged battery

Fig 11-4: Charging battery

Common misconceptions about battery

Common misconceptions about the deep cycle battery of electric vehicle and the maintenance of the battery are shown in the table below.

Problems	Misconceptions	Actual states
	"The electric vehicle runs slowly,	Try to avoid the deep discharge
Deep discharge	but we still can have it run until it	of battery. Please refer to "deep
	has no electrical energy."	discharge ".
		The new battery cannot reach
	"Those are now bottories	its full capacity until being used
Dramatura avecasiva disabaras	"These are new batteries.	and charged for twenty to fifty
Premature excessive discharge	Therefore they can supply	times. Please refer to
	power all day long."	"premature excessive
		discharge".
		Your tap water may be OK, but
NA: and antent	"Our batteries can use tap	inspection before hand is
Mineral content	water."	required. Please refer to
		"mineral content".

Self discharge	"The dirt and rust on the battery will do no harm."	The dirt and rust may form current passage, which results in the self discharge of battery. Please refer to "self discharge".
Over-watering	"Fill water into the battery to the liquid level in the evening. Therefore, water filling is not necessary in the morning."	In most cases, water must be filled into the battery after charging. Please refer to "liquid level of electrolyte".
Under-watering	"It takes too much time to inspect the water, and the inspection can be made one a month."	Under-watering is harmful to the battery. The water level should be inspected once a week. Please refer to "liquid level of electrolyte".
Vibration damage	"The user should secure the battery hold-down gear to the best possible degree."	The user should secure the hold-down gear of the battery following the instructions. Too tight or too loose hold-down gear will result in the damage of the battery. Please refer to "vibration damage".

Battery replacement

Δ WARNING

- The battery must be handled by special lifting tools. To prevent the electrolyte from leaking out of the battery air bleeders, the battery must remain upright. Inclination of over 45°towards any direction may result in the leakage of small amount of electrolyte from the air bleeder. The inclination of the battery should not exceed 45°when being lifted, carried or mounted. The battery acid may result in serious personal injury to the skin or eyes, and may also damage the clothes.
- 1. Before removing the battery, please note the orientation of the battery and connecting line. Disconnect the battery cable according to the instructions. Please refer to Chapter 1 "Protection for Electrical Safety". Remove the remaining wires and battery. Please refer to the wiring diagram on page 9-7.
- 2. Visually inspect the new battery for damage in transit.
- 3. The original battery cable, if to be used again, should be inspected for rupture or abrasion. In addition, its terminals should be inspected for damage, or the insulating layer for aging. Please erase the rust and dirt on the connector. The solution of sodium bicarbonate and water (a gallon (3.8L) of water is mixed with a glass (237mL) of sodium bicarbonate) can effectively neutralize and erase the rusty stain. Care should be taken to avoid the sodium bicarbonate solution from entering the battery.



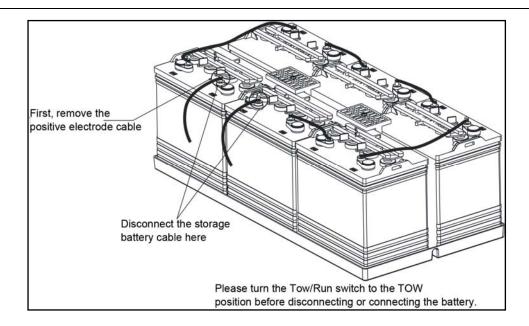


Fig 11-5: Schematic diagram of electric vehicle battery

- 4. Inspect and clean the battery support and hold-down gear. The nuts and bolts on the hold-down gear may rust. Therefore, it is suggested that they are cleaned on a regular basis, and be replaced when necessary.
- 5. Mount the battery in the right direction (see Fig 11-5). Mount the battery hold-down gear. The hold-down gear must be sufficiently tight to secure the battery when the electric vehicle is in operation to such a degree that the battery enclosure is not cracked or bent. Tighten the hold-down bolts with 40 in-lb (4.5N m) torque.
- 6. Mount the wires in the right order (see Fig 11-5). At last, connect the negative terminal of the battery pack. Ensure all the wires are in good connection. Tighten with 110 in-lb (12.4N m) torque. Apply terminal protection oil to all connecting terminals to minimize the potential corrosion.
- 7. Fully charge the battery before use. In this way, the battery can be ensured to have been fully charged before use, and the electric quantity of the battery compartment is balanced.

Battery maintenance

Preventative maintenance

To maintain the battery in good working order, please take the following procedures regularly:

- The rust and dirt on or around the battery should be cleaned immediately. The terminal joints should be cleaned and secured. Replace the aged or worn wires. Apply the terminal protection oil to all the connecting terminals after all cables are connected to prevent future corrosion.
- 2. The battery should remain clean and rust-free. Clean the battery top and connecting terminal with sodium bicarbonate and water solution (one gallon (3.8L) water is mixed with 1 glass (237mL) of sodium bicarbonate). Clean the solution with fresh water. The solution should be prevented from



entering the battery. Ensure the connecting terminals are tightly secured. When all terminals are dried, apply the terminal protection oil to all the connecting terminals. Please refer to "self discharge".

- 3. Maintain the electrolyte at normal liquid level. Please refer to "electrolyte liquid level".
- 4. The battery should be charged every day after it is used. Inspect the battery periodically to ensure that the battery is fully charged. Please refer to "battery charging".
- 5. Tighten the hold-down gear. Please refer to "vibration damage".

Self discharge

The dirt on the battery may form weak battery passage, which may result in slow discharge of the battery and therefore waste the precious electrical energy. To avoid self discharge, the battery should remain clean all the time.

The temperature also has influences on the speed of self discharge by the battery. The higher the temperature is, the quicker a set of battery is discharged. In hot regions, the battery should be inspected more frequently. The battery should be stored in shady and cool places. Please refer to "storage of battery".

Electrolyte liquid level

A NOTICE

• The battery acid exuded from the battery cover or hydrometer should be prevented from dropping onto the front or rear body of the electric vehicle. Battery acid may result in irremediable defect, and should be cleaned up immediately.

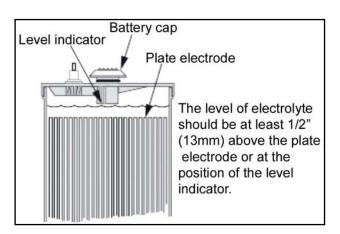


Fig 11-6: Liquid level of battery solution

Water is filled only when the liquid level of electrolyte is lower than the height of positive and negative plates. In case the liquid level of electrolyte is lower than the height of positive and negative plates, please fill enough water to cover the plates before charging the battery. After charging, re-fill the water to



liquid level benchmark. This is because the liquid level of electrolyte may rise when the battery is charged. Some electrolyte may burst out of the battery cover. Therefore, filling water to the liquid level before battery charging may result in the spillage. This will reduce the battery capacity and corrode its neighboring metal components.

The electrolyte liquid level should be inspected once a week to ensure that the electrolyte is maintained at the normal liquid level (see Fig 11-6). Never allow the electrolyte be lower than the top of the positive and negative plates, as this will result in the permanent inertia of exposed plates. To achieve the optimum result, please fill water into the battery with watering gun. In hot weather or when the battery becomes aged, the liquid level of electrolyte should be inspected more frequently.

Mineral content

To prolong battery life to the longest possible degree, the battery should be filled with distilled water. In case tap water is to be used, the water must be ensured to contain minerals of which the contents are below the level specified below:

Impurities	Allowable content (ppm)
Suspended substance	Cannot be viewed visibly
Total solid	100.0
Calcium and magnesium oxides	40.0
Iron	5.0
Ammonia	8.0
Organic matter	50.0
Nitrate	10.0
Nitrite	5.0
Chloride	5.0

Vibration damage

The battery hold-down gear should remain tight and secure to prevent the battery from jumping out. In case the battery hold-down gear is too loose, the service life of the battery may be shortened to a great extent. Secure the hold-down gear with a load of 40 in-lb (4.5 N • m). With too strong vibration, the positive and negative plates may come off prematurely and the battery life may be shortened. It may also result in the leakage of acid fluid from air bleeder cover and in the accumulation of rust and dirt on the neighboring metal components. The lost acid fluid may reduce the battery capacity and cannot be replaced. However, the battery hold-down gear shouldn't be too tight, so as to prevent the battery enclosure from being fractured or bent. This will result in leakage, and further to the dry-up of the battery compartment or short circuit. Please refer to Chapter 1 "Protection for Electrical Safety".



Battery charging

The charger provided for the E-merge electric vehicle has brought a solution to the common problem relating to the battery charging. The charger can shut off automatically to prevent undercharge and overcharge. Meanwhile, all battery compartments are automatically distributed with balanced electric quantity by the light current in such a way to prolong the service life of the battery. Never allow the battery to be in the discharge condition, as it may affect the internal components and reduce the battery capacity. The battery should be charged every day after it is used. In case the battery is not used, no charging is required.

In case any of the following situations: 1 new battery; 2 long-term use; 3 the humidity is too low, additional charge may be required. The electric quantity of battery of electric vehicles that are not in operation should be inspected. The battery of which the specific gravity is less than 1.250 requires additional charge. In case the problem still remains unsettled after the additional charge, the charger of the battery should be inspected. Please refer to "battery charger".

Deep discharge

It is strictly prohibited to charge the battery until it has no enough power to drive the vehicle. This may shorten the cycle life of the battery remarkably, and may result in the irremediable defect of the battery. In case the battery is fully discharged, it may be unable to be charged any longer. To more the battery is discharged, the harder the battery is able to bear. Therefore, it is suggested that every time the battery is used (in case the charging cycle is not interrupted and the charger can shut off automatically), the electric vehicle is charged. Charging the battery every time it is used can diminish the discharge depth and prolong the service life of the battery.

Premature excessive discharge

In case the new battery is used, it will not reach its full capacity before it is used and charged for 20 to 50 times. IN case the new battery is over-discharged during its service life, its effective service life will be shortened, and it is therefore suggested that the use of electric vehicle in the first four weeks is restricted before it will be used for wider ranges.

AC power supply line

Ensure that the power supply line providing the alternating current has adequate capacity. In case the breaker trips, the fuse is burnt at night or the charger fails to reach the required starting velocity when it charges the normal battery, the problem may lie with the AC power line. When all charges are open, the power supply line of the storage facility of the electric vehicle can supply sufficient voltage and current for each charger. In case it fails to do so, please consult with the local power company or electricity inspector. Please refer to "battery charger".



Battery and Charger

Chapter 11

Alternating use of vehicles

Use the electric vehicles alternately. In case the vehicle came back the last yesterday evening is dispatched as the first one the next morning, its battery is hard to sustain. The workload should be equally allocated so that all electric vehicles are equally used. This can balance the use of vehicles and prevent the overwork of some batteries.

Electric vehicle and charger numbering

If possible, the electric vehicle is desirable to be charged by one and the same charger every night. In case the electric vehicles are stored in the garage at random, and one of the vehicles breaks down during operation and the inspection shows that the battery is normal, the cause may very likely be the abnormality of the charger. However, it is time-consuming to detect the problematic charger. Number the vehicle and the charger, and drive the vehicle to the designated charger, which can greatly reduce the time spent on detection of the problematic charger.



Battery troubleshooting diagram

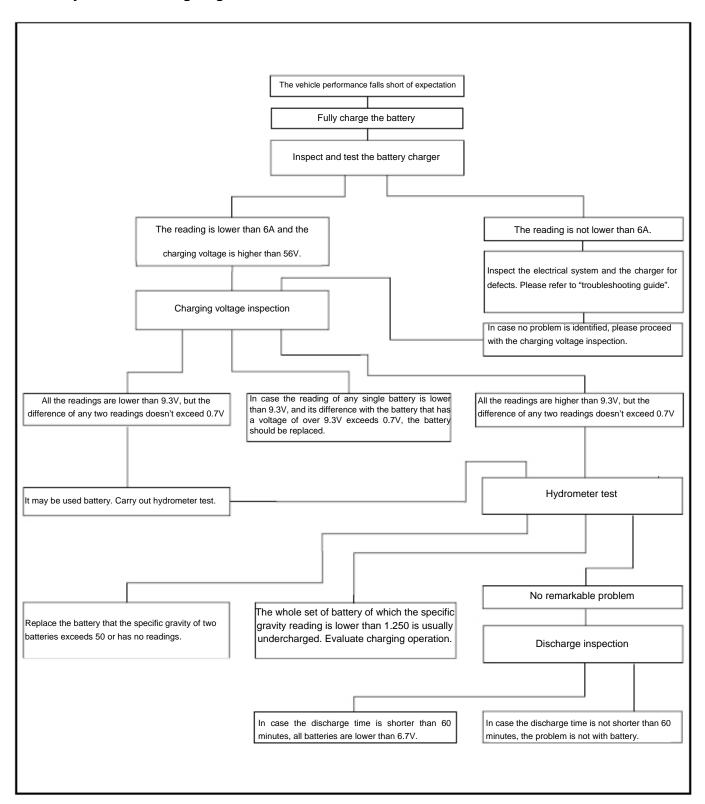


Fig 11-7: Battery troubleshooting diagram

Battery and Charger

Chapter 11

Inspection and test of the battery

Please refer to Chapter 1 "Protection for Electrical Safety".

Carry out four inspections to find out the cause to the battery performance reduction. As these inspections are more and more detail and time-consuming, please carry out the inspection from the beginning before proceeding to other inspections until the problem is identified as shown in "battery troubleshooting diagram" (see Fig 11-7).

Inspection and test of the battery charger

The easiest way to monitor the battery of the vehicle is to observe the reading on the ampere-meter of the battery charger on completion of one charge cycle. When the battery is fully charged, unplug the DC connector of the charger and wait for 20-30 seconds before reconnecting the DC connector of the charger. The pointer of the ammeter will jump to over 15A, and then drop below 6A in 10 to 20 minutes, which means the battery is normal and fully charged. In case the performance is still poor, the problem may lie with the electrical system, braking system or the battery charger of the vehicle. In case no problem is identified from the electric vehicle or the charging system, inspection of the additional voltage should be made. The battery of over 8V should also go through charging voltage inspection.

Charging voltage inspection

When the battery is fully charged, unplug the DC connector of the charger. Wait for 20-30 seconds before reconnecting the DC connector to restart the charger. Five minutes later, measure and record the voltage of the battery pack and of each battery with the multimeter. Set the multimeter at 200V DC. Attach the red (+) probe to the positive (+) terminal of No.1 battery, and attach the black (-) probe to the negative (-) terminal of the battery pack (see Fig 11-5). Take down the reading. Then set the multimeter at 20V DC. Attach the red (+) probe to the positive (+) terminals of all batteries, and attach the black (-) probe to the negative (-) terminals of all batteries. Take down the reading. The charged battery of the battery pack should have a voltage between 56.0-63.0V, which is subject to the years it is used and the electric quantity of the inspected battery. In case the reading of a single battery is higher than 9.3V, and the difference of readings do not exceed 0.7V, the inspection by hydrometer should be conducted. In case the reading of any single battery is lower than 9.3V, and its difference with the battery that has a voltage of over 9.3V exceeds 0.7V, the battery should be replaced. In case the reading of any single battery is lower than 9.3V, but its difference with other reading does not exceed 0.7V, it means the battery is too old. The capacity of the old battery may be able to sustain for a few months. Inspection with the hydrometer shall be conducted.

Inspection with hydrometer

The specific gravity of the battery electrolyte can be measured by the hydrometer. The higher the specific gravity is, the more electric quantity the battery has. When the temperature is 80 $^{\circ}F$ (26.7 $^{\circ}C$), the reading of the fully charged battery should range between 1.250 and 1.280. Never increase the specific gravity by means of filling acidic fluid into the battery.



Procedures for inspection with hydrometer

- 1. Before inspection, first ensure that the battery has sufficient electrolyte to cover the electrode plates by about 1/2 inch (13mm) and is fully charged. In case it is a must to fill water, the batter should be recharged before the inspection with hydrometer.
- 2. Remove the air bleeder cover. Measure with the thermometer and take down the electrolyte temperature at Battery Compartment No.2.
- 3. Extrude the rubber bag of the hydrometer before inserting the battery compartment. Release the rubber bag slowly so that the electrolyte is sucked into the glass tube of hydrometer.
- 4. Adjust the liquid level of the electrolyte when the buoy floats above the bottom to such a degree that the buoy is in neither contact with the bottom nor the top of the glass tube. Take down the hydrometer from the battery compartment before releasing the pressure of the rubber bag.
- 5. Take hold of the hydrometer vertically so that the buoy will not touch the sidewall. Raise the hydrometer to the height the same as the eyes and observe the scale value of the liquid level of electrolyte (see Fig 11-8).
- 6. Take down the reading and enable the electrolyte in the hydrometer to return back to the battery compartment. Replace the air bleeder cover.
- 7. Repeat Step 2-6 to all battery compartments.

Calibration of hydrometer

Most of the hydrometers are calibrated and can perform precise measurement under $80^{\circ}F$ ($26.7^{\circ}C$). The above observed readings should be corrected according to the temperature. Every increase of $10^{\circ}F$ ($5.6^{\circ}C$) over $80^{\circ}F$ ($26.7^{\circ}C$) should result in the addition of 0.004 to the reading. Every decrease of $10^{\circ}F$ ($5.6^{\circ}C$) below $80^{\circ}F$ ($26.7^{\circ}C$) should result in the subtraction of 0.004 from the reading.

Hydrometer inspection result presentation

The table below shows the rough electric quantity the charged battery has:

Specific gravity (corrected with the temperature)	Rough charging condition
1.250-1.280	100%
1.220-1.240	75%
1.190-1.210	50%
1.160-1.180	25%

In case the difference between batteries is not less than 0.020, the problem may lie with the battery compartment with relatively lower specific gravity. It may need additional charge or may be light current battery. In case the difference between batteries is not less than 0.050, the battery with relatively low specific gravity should be replaced.



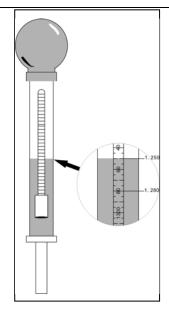


Fig 11-8: Hydrometer

Vehicle	Battery	Electrolyte Correction Corrected specific gravity						Measures
number	number	temperature	factor	Battery 1	Battery 2	Battery 3	Battery 4	should be taken
12	1	20°F (-6.6°C)	024	1.275 –.024 =1.251	1.280024 =1.256	1.280024 =1.256	1.280024 =1.256	Normal battery-fully charged
35	6	90°F (32.2°C)	+.004	1.155+ .004 =1.159	1.165+ .004 =1.169	1.160+ .004 =1.164	1.165 –.004 =1.169	Discharged battery-charge
54	3	50°F (10°C)	012	1.260012 =1.248	1.200012 =1.188	1.270012 =1.258	1.270012 =1.258	Defective battery
69	5	80°F (26.7°C)	.000	1.250 – 0 =1.250	1.255 – 0 =1.255	1.230 – 0 =1.230	1.250 – 0 =1.250	Light current battery 3-additional charge
38	2	100°F (37.8°C)	+.008	1.200+ .008 =1.208	1.180+ .008 =1.188	1.170+ .008 =1.178	1.180+ .008 =1.188	Discharged battery-recharge and re-inspection
22	4	80°F (26.7°C)	.000	1.240 – 0 =1.240	1.245 – 0 =1.245	Buoy doesn't float	1.250 - 0 =1.250	Rejected battery 3-replacement

Discharge test

In case no problem is identified after the above inspections, the discharge test should be conducted. Simulate the operation mode of the vehicle to carry out the discharge test by reducing the battery output current to voltage 42.0.



The discharge test is the most difficult and time-consuming test. Please use battery discharge tester.

Procedures for discharge test

- 1. Ensure that the battery is fully charged and that the liquid level of electrolyte in battery compartment is normal.
- 2. Connect the tester with the positive (+) terminal of battery No.1 and the negative terminal of battery No. 6 (see Fig 11-9).
- 3. Inspect and take down the temperature of electrolyte of the battery pack. Inspect the second compartment of each battery (the second one from the positive terminal).
- 4. Reset the discharger and restart the tester.
- 5. Sixty minutes after the discharge of the battery, set the discharger at function 3 and measure the voltage of the battery pack. In the subsequent test, measure the voltage every ten minutes. Measure with the multimeter the voltages of all batteries when the voltage of the battery pack is higher than the shutoff point (42.0V) by 5V. Be accurate to 0.01V and measure and take down the voltages of all batteries.

NOTE: When the shut-off voltage is reached, the tester will shut off automatically.

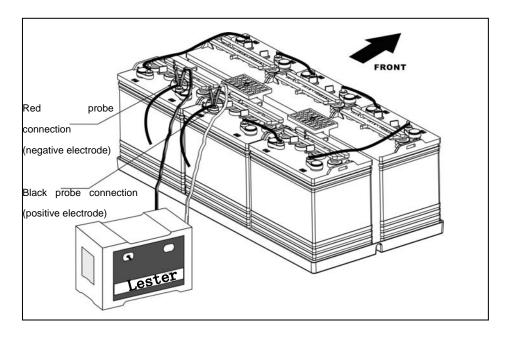


Fig 11-9: Battery discharge test

Discharge test result presentation

- 1. In case the discharge time is not less than 60 minutes, the problem is not with battery.
- 2. In case the discharge time is relatively short (shorter than 60 minutes), the battery should be replaced with one of 6.7V.



Battery and Charger

		Battery	Datton, condition			
1	2	3	4	5	6	Battery condition
7.00V	7.00V	7.00V	7.00V	7.00V	7.00V	Very good
7.07V	7.07V	7.22V	6.50V	7.07V	7.07V	The service life of batter No 4 is to expire.
7.20V	7.20V	6.67V	7.33V	6.27V	7.33V	The service lives of battery No 3 and 5 are to expire.

3. The battery pack of which the discharge time is less than 60 minutes during the discharge test under $78^{\circ}F$ (25.6°C) usually cannot sustain a vehicle shift. However, the discharge time is dependent on the temperature of the electrolyte. The table below shows the discharge time under different temperatures of the battery pack of which the discharge time exceeds 62 minutes under $80^{\circ}F$ (26.7°C).

Electrolyte temperature	Discharge time when the shut-off point is reached	the shut-off point is	
40-49°F (4-9°C)	40 minutes	85-89°F (29-32°C)	64 minutes
50-59°F (10-15°C)	45 minutes	89-99°F (32-37°C)	66 minutes
60-64°F (16-18°C)	50 minutes	100-109°F (38-43°C)	68 minutes
65-69 °F (18-21°C)	54 minutes	110-119°F (43-48°C)	70 minutes
70-74 °F (21-23 °C)	57 minutes	120-129°F (49-54°C)	72 minutes
75-79 °F (24-26 °C)	60 minutes	130-150°F (54-66°C)	74 minutes
80-84 °F (27-29°C)	62 minutes	****	****

Battery troubleshooting example

Below is the battery troubleshooting example.

Example 1:

Due to the poor performance of the electric vehicle and the battery is suspected to be the cause, the battery charger is inspected. When the battery is fully charged, the reading on the ammeter of the battery charger is 8.0A. The charging voltage inspection is conducted and the results are recorded.

Battery number	1	2	3	4	5	6
Charging voltage	10.15V	10.60V	9.80*V	10.16V	10.56V	10.61V

^{*}As battery No. 3, No 1 and No 4 are suspected to have problems, hydrometer inspections are conducted on all batteries.

Battery and Charger

Chapter 11

Hydrometer inspection result:

Battery compartment	Battery number						
number	1	2	3	4	5	6	
Battery 1 (positive terminal)	1.200*	1.265	1.300	1.250	1.280	1.260	
Battery 2	1.285	1.275	1.290	1.270	1.295	1.265	
Battery 3 (negative terminal)	1.265	1.270	1.275	1.265	1.280	1.275	
Battery 4 (negative terminal)	1.275	1.270	1.285	1.265	1.275	1.275	

^{*}After the hydrometer inspection, the problem seems to lie with Battery 1. Proceed with the discharge test

Discharge test result:

Battery number	1	2	3	4	5	6
Discharge voltage	5.44*V	7.33V	7.73V	7.15V	7.43V	7.41V

^{*}It is apparent that the problem lies with Battery 1 after the 45 minutes discharge test. After further observation of Battery 4, the battery proves to be normal. Replace Battery 1 with the one that has been used for the same period of time for the same electric quantity as those in the battery pack.

Battery storage

Please refer to Chapter 1 "Protection for Electrical Safety".

Please follow the instructions below to store the battery that will not be used for a long time:

- 1. Keep the battery clean and rust-free. Please refer to "battery maintenance".
- 2. In case the battery in the vehicle is stored in winter and is not necessary to be connected with the charger, the battery of the electric vehicle should be disconnected.
- Fully charge the battery before storage.
- 4. Store the battery in shady and cool places. The lower the temperature where the battery is stored is, the less electricity quantity the battery self discharges. The electric quantity discharged by the battery stored in 0°F (−17.8°C) temperature is very little. The battery stored under 80°F (26.7°C) temperature will discharge every few weeks.
- The 48V E-merge electric vehicle that is not to be used for a long time is preferably to be stored with the battery connected to the AC compatible battery charger. During the storage, the battery charger will automatically charge the battery when necessary.

Charge of the battery pack with low electric quantity

Please refer to corresponding maintenance and repair of the battery charger.



Battery charger

Overview

E-merge charger is fully automatic and designed to charge the storage battery of the electric vehicle.

The battery charger can be connected to the vehicle of any mileage, and will continue to charge the battery as long as it is not disconnected. Insert the receptacle into the vehicle. Before starting it, the charger has three seconds of time delay.

During the charging, the electronic modules in the charger will sample the voltage of the storage battery. In case the module detects that the voltage of storage battery is on the rise, it will continue to charge the battery. In case the module detects that there is no voltage rise, it will conclude that the storage battery is fully charged and will shut off the charger.

Conditions to be noted before charging

WARNING A Electric shock hazard

The vehicle is provided with the on-board charger. Before the operation of the charger, the vehicle must be driven to and stopped at a platform higher than the ground in such a way to allow the maximum draught blow and surrounding the charger. In case the charger is used outdoors, rain and sun shields must be provided (see Fig 11-10). The charger needs a special circuit. For proper circuit protection method, please refer to the operating instructions of the charger.

The charger can be connected to the AC mains jack all the time. For charging method, please refer to the descriptive label on the charger. The spring connector must be fully inserted into the on-board receptacle (see Fig 11-11).

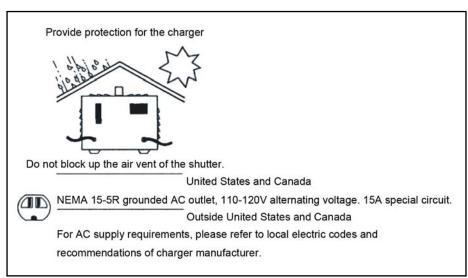


Fig 11-10: Charger protection schematic diagram



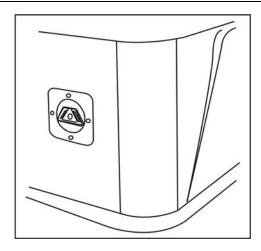


Fig 11-11: Electrical outlet

The charger will start automatically a few seconds after the connectors are plugged in. When the storage battery is fully charged, the charger will automatically stop the charging. Unplug the DC connector to use the vehicle.

NOTICE

It is a good way to fasten the DC wire on the steering wheel when the battery is charged, which can work perfectly as a reminder so that the user can store up the wires not to be used after the charging. Driving over or dragging the wires when the vehicle is in operation will damage the DC connector.

▲ WARNING **▲**

Ungrounded electric installation will be a material hazard for electric shock or electrocution.

The charging (dc) wire is provided with a polarization connector that can be plugged into the on-board electrical outlet.

Power supply (AC) wire is provided with a grounded connector. Never unplug, cut off or bend the ground pole.

NOTICE

In case the vehicle is to be charged with a non E-merge charger, please refer to instructions provided with the charger.

Get to know the charger

The battery charger will respond to abnormal conditions.

- 1. In case the charger is disconnected with the vehicle during the charge cycle, it will shut off immediately.
- 2. In case the AC supply is disconnected, when the power supply is resumed, the charge cycle will



continue till the remaining cycle is completed.

- 3. In case the storage battery is fully charged in a very short period (less than 2 hours), the charger will shut off. In case the voltage of open circuit storage battery drops down to a point where the recharge is needed, the charger will start and charge the battery till it is fully charged.
- 4. The feature of the charger is that it has an internal timer, which allows at most 16 hours of trickle charge.

▲ WARNING **▲**

To prevent the hazard of electric shock or arc discharge that will result in serious personal injury or serious damage to the equipment or the charger, before the repair or maintenance procedures, please see to it to unplug the charger from the AC and DC power supply.

Removal of the charger

M WARNING **A**

When the charger is still connected with the power supply, it has lethal voltage when the cover is removed.

If you suspect your ability to safely perform the following tests, you can ask the trained electrician/technician to repair the charger.

Please extremely careful not to make the non-insulated part of the testing spike touch any other parts or the charger frame.

Remove the bolt (1 and 2) on the charger cover and other bolts on the side. Hold the handle on the cover of the charger and lift up the charger cover. The installation procedures are revere to the removal procedures. (See Fig 11-12)

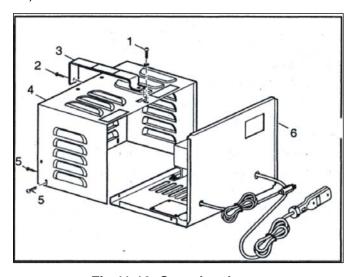


Fig 11-12: Start the charger

Maintenance of the battery charger

The only maintenance the charger requires is the periodic cleaning of the auxiliary contacts of AC connector.

To clean the auxiliary contacts, please press down the elastic connector protective sleeve (See Fig 11-13). Wrap the connector with the emery paper and wipe back and forth for about 10 to 20 times. Keep the pressure on the cleaned contact surface.

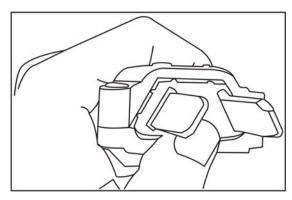


Fig 11-13: Clean the auxiliary contacts of the charger plug



SAVE THESE IMPORTANT SAFETY INSTRUCTIONS



This manual contains important safety, operating, and installation instructions – read before using charger.

Battery Safety Information

Warning: Use charger only on battery systems with an algorithm selected that is appropriate to the specific battery type. Other usage may cause personal injury and damage. Lead acid batteries may generate explosive hydrogen gas during normal operation. Keep sparks, flames, and smoking materials away from batteries. Provide adequate ventilation during charging. Never charge a frozen battery. Study all battery manufacturers' specific precautions such as recommended rates of charge and removing or not removing cell caps while charging.

Electrical Safety Information

Danger: Risk of electric shock. Connect charger power cord to an outlet that has been properly installed and grounded in accordance with all local codes and ordinances. A grounded outlet is required to reduce risk of electric shock – do not use ground adapters or modify plug. Do not touch uninsulated portion of output connector or uninsulated battery terminal. Disconnect the AC supply before making or breaking the connections to the battery while charging. Do not open or disassemble charger. Do not operate charger if the AC supply cord is damaged or if the charger has received a sharp blow, been dropped, or otherwise damaged in any way – refer all repair work to qualified personnel. Not for use by

INFORMATIONS IMPORTANTES DE SÉCURITÉ

Conserver ces instructions. Ce manuel contient des instructions importantes concernant la sécurité et le fonctionnement. Information de Sécurité de la Batterie

Attention: Utiliser seulement sur les batteries 72V avec un algorithme approprié au type spécifique de batterie – voire le manuel. D'autres types de batteries pourraient éclater et causer des blessures ou dommages. Les batterles peuvent produlre des gaz explosives en service normal. Ne jamais fumer près de la batterie et éviter toute étincelle ou flame nue à proximité de ces derniers. Fournisser la bonne ventilation lors du chargement. Ne jamais charger une batterie gelée. Prendre connaissance des mesures de précaution spécifiées par le fabricant de la batterie, p. ex., vérifier s'il faut enlever les bouchons des cellules lors du chargement de la batterie, et les taux de chargement recommandés.

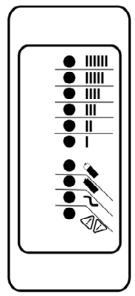
Information de Sécurité Électrique

Danger: Risque de chocs électriques. Ne pas toucher les parties non isolées du connecteur de sortie ou les bornes non isolées de la batterie. Toujours connecter le chargeur à une prise de courant mise à la terre. Ne pas ouvrir ni desassembler le chargeur – referer toute reparations aux personnes qualifiés. Pas à l'usage des enfants.

Operating Instructions

- 1. Always connect the charger to a **GROUNDED** outlet. When using an extension cord, avoid excessive voltage drops by using a grounded, 3-wire, 12-AWG cord no longer than 30m (100').
- AVOID connecting a QuiQ charger and another device to a single 15A/20A circuit or the circuit may become overloaded.
- 3. Charger 10-LED Display

LED indications following "Power-On Self Test":



Ammeter		Displays approximate scale of current output during bulk phase.
	Flashing:	High internal charger temperature. Current output reduced.
<u>II</u>		Also displays algorithm #1-6 for 11 seconds if no battery is connected.
80% Charge	Solid:	Bulk charge phase complete, 80% charged.
(Amber)		In Absorption phase.
	Flashing:	With no battery connected, indicates
		algorithm # selected by number of flashes.
100% Charge	Solid:	Charging complete. Charger in
(Green)		Maintenance Mode.
	Flashing:	Absorption phase complete. In Finish phase
AC On	Solid:	AC Power good
(Amber)	Flashing:	Low AC Voltage, check voltage and
,		extension cord length (max 100', 12-AWG).
Fault (Red)	Flashing:	Charger error. Reset charger power and refer to Troubleshooting below.



Troubleshooting

The simple and effective way to spot the defective battery charger is to follow the troubleshooting procedures (see Fig 11-15).

Continuity inspection



To carry out continuity inspection, please see to it to disconnect the battery charger from the AC and DC mains.

To inspect the continuity, please set the DVOM (digital volt/ohm meter) to kilo-ohm and select "continuity". The DVOM will send an audible signal when the connection is detected. In case the DVOM has no connection configuration, then configure the DVOM at kilo-ohm. When the connection is detected, the DVOM will display "0". (See Fig 11-14)

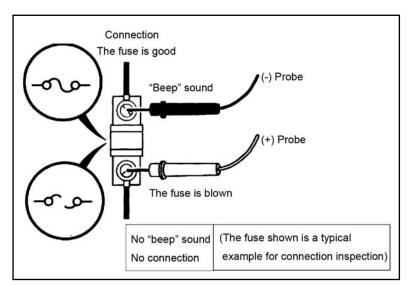


Fig 11-14: Continuity inspection

Diode test procedure

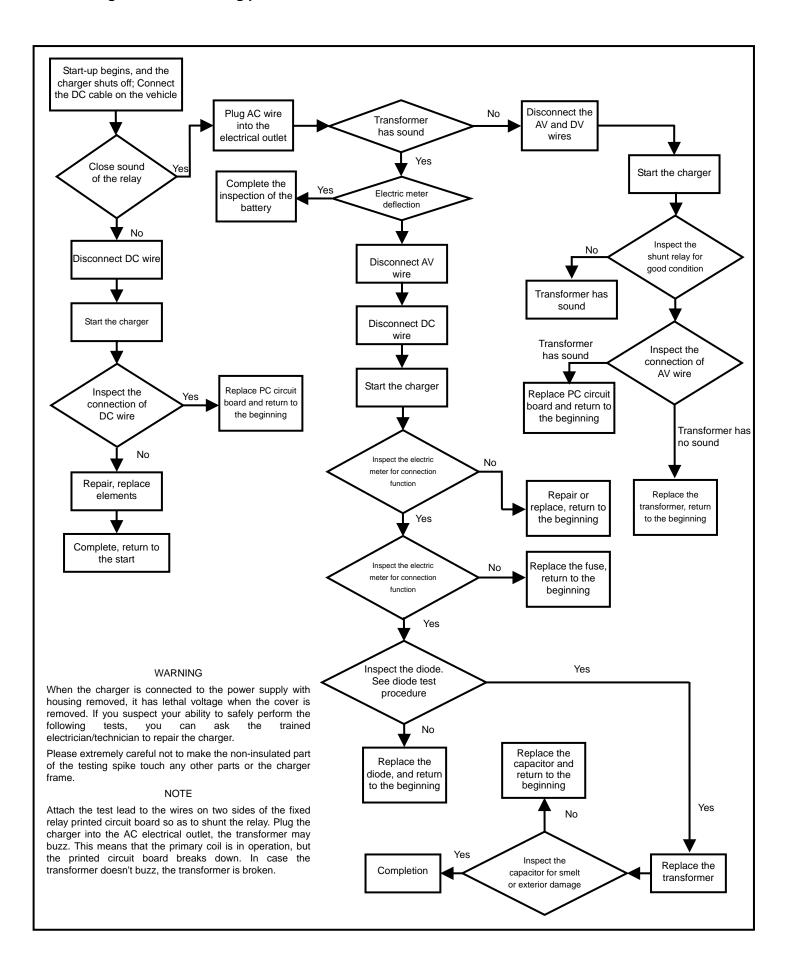
To test the diode, first disconnect the AC supply of the battery charger. After setting the DVOM at the highest usable ohm range, attach the probe to the diode (see Fig 11-16). In case the reading is not the given one, the diode is broken. It can be replaced as required.

Procedures for component replacement

To replace the parts, install them in the procedures just reverse to the removal procedures. Any disconnected wire should be given special attention. Please see to it to install them in their original places.



Charger trouble-shooting procedure





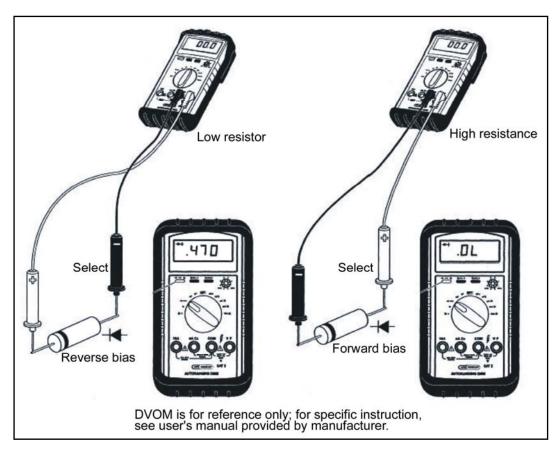


Fig 11-15: Charger trouble-shooting procedure



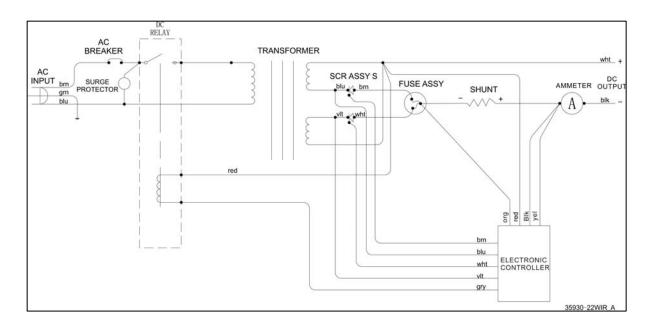


Fig 11-17: lester full automatic controllable silicon charger wiring diagram



On-board charger

Operating Instructions

- 1. Always use a grounded outlet. When using an extension cord, avoid excessive voltage drops by using a grounded 3-wire 12 AWG cord.
- 2. The charger will automatically turn on and go through a short LED indicator self-test(Models 912-xx0x will flash all LED's in an up-down sequence and Models 912-xx1x will alternatively flash its LED RED-GREEN) for two seconds. If the charger is connected to battery pack, a trickle current will be applied until a minimum voltage is reached. If the charger is used in an off-board application and the charger is waiting to be plugged into a batter pack, the charging algorithm number will be displayed for 11 seconds(see "Check/Change Charging Algorithm") before ultimately displaying an under-voltage fault(fault disappears when plugged into battery pack).
- 3. Once a minimum battery voltage is detected, the charger will enter the bulk charging constant-current stage. Models 912-xx0x will display the current to the battery on the bar graph and Model 912-xx1x will flash its LED GREEN off more than on to indicate<80% charge status. The length of charge time will vary by how large and how depleted the battery pack is, the input voltage (the higher, the better), and ambient temperatures (the lower, the better). If the input AC voltage is low (below 104VAC), then the charging power will be reduced to avoid high input currents (Models 912-xx0x 'AC' LED and Models 912-xx1x single LED both flash YELLOW). If the ambient temperature is too high, then the power will also be reduced to maintain a maximum internal temperature (Models 912-xx0x bar graph flashes and Models 912-xx1x single LED flashes YELLOW).
- 4. When the battery is at approximately 80% state of charge, the bulk stage has completed and an > 80% charge indication is given (Models 912-xx0x turn on the '80%' LED and Models 912-xx1x will flash its LED GREEN on more than off). In the next phase known as the absorption or constant-voltage phase, the last 20% of charge is then returned to the battery. The charging could be terminated at this point if the vehicle requires immediate usage, however, it is highly recommended to wait until 100% charge indication is given to ensure maximum battery capacity and life.
- 5. A low current "finish-charge" phase is next applied to return and maintain maximum battery capacity (Models 912-xx0x will flash the '100%' LED).
- 6.When Models 912-xx0x "100%" LED or Models 912-xx1x single LED is continuously GREEN, the batteries are completely charged. The charger may now be unplugged from AC power (always pull on plug and not cord to reduce risk of damage to the cord). If left plugged in, the charger will automatically restart a complete chare cycle if the battery pack voltage drops below a minimum voltage or 30 days has elapsed.
- 7. If a fault occurred anytime during charging, a fault indication is given by flashing RED with a code corresponding to the error. There are several possible conditions that generate errors. Some errors are serious and require human intervention to first resolve the problem and then to reset the charger by interrupting AC power for at least 15 seconds. Others may be simply transient and will automatically recover when the fault condition is eliminated. To indicate which error occurred, a fault indication will flash RED a number of times, pause, and then repeat.
 - [1 FLASH] Battery Voltage High: auto-recover
 - [2 FLASH] Battery Voltage Low: auto-recover
 - [3 FLASH] Charge Timeout: the charge did not complete in the allowed time. This may indicate



- a problem with the battery pack (voltage not attaining the required level), or that the charger output was reduced due to high ambient temperatures.
- [4 FLASH] Check Battery: the battery pack could not be trickle charged up to the minimum level required for the charge to be started. This may indicate that one or more cells in the battery pack are shorted or damaged.
- [5 FLASH] Over-Temperature: auto-recover. Charger has shutdown due to high internal temperature which typically indicates there is not sufficient airflow for cooling-see installation instructions 1). Charger will restart and charge to completion if temperature comes within accepted limits.
- [6 FLASH] QuiQ Fault: an internal fault has been detected. If fault 6 is again displayed after interrupting AC power for at least 15 seconds, the charger must be brought to a qualified service depot.

Maintenance instructions

- For flooded lead-acid batteries, regularly check water levels of each battery cell after charging and add distilled water as required to level specified by battery manufacturer. Follow the maintenance and safety instructions recommended by the battery manufacturer.
- 2. Make sure charger connections to battery terminals are tight and clean.
- 3. Do not expose charger to oil, dirt, mud or to direct heavy water spraying when cleaning vehicle.

Specifications

DC Output-see Operating Instructions

QuiQ Model:912-	48xx
Voltage-nom(v)	48
Voltage-max(v)	67.2
Current-max(A)	18
Battery Type	Specific to selected algorithm
Reverse Polarity	Electronic protection-auto-reset
Short Circuit	Electronic current limit

Ac input

All models	
Voltage-max(Vrms)	85—265
Frequency(Hz)	45—65
Current-max(Arms)	12A @ 104VAC(reduced 20%<104)
Current-nominal(Arms)	10A @ 120VAC/5A @ 230VAC
AC Power Factor	>0.98 at nominal input current

Battery and Charger

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Operation		
Charger Model:912-	Xx0x(10 LED)	Xx1x(1 LED)
AC ON	Solid YELLOW	LED Active
AC Low	Flash YELLOW	Flash YELLOW
Thermal Cutback	Flash Bar graph	Flash YELLOW
<80% Charge Indicator	-	Short Flash GREEN
>80% Charge Indicator	Solid YELLOW	Long Flash GREEN
100% Charge Indicator	Solid GREEN	Solid GREEN
Fault Indicator	Flash RED	Flash RED
DC Ammeter	LED Bargraph	-
Bat Temp Compensation	Automatid	Optional
Maintenance Mode	Auto-restart if V<2.1Vpc or 30 days elapse	

Installation Instructions

WARNING:

The output of chargers with greater than 48V may pose an energy and/or shock hazard under normal use. These units must be installed in the host equipment in such a manner that the output cable and battery connections are only accessible with the use of a tool by qualified personnel.

1) Determine Mounting location:

While its sealed nature allows the charger to be mounted virtually anywhere, the choice of mounting location and orientation is extremely important. For optimum performance and shortest charge times, mount the charger in an area with adequate ventilation. The charger should also be mounted in an area that will be relatively free of oil, dirt, mud, or dust since accumulations within the fins of the charger will reduce their heat-dissipating qualities. Optimal cooling also occurs when the charger is mounted on a horizontal surface with the fins vertical. More airflow from below the charger will help cool the fins, so mounting above open areas or areas with cut-outs for airflow is desirable. Contact Delta-Q for information on other mounting orientations. As the charger may get hot I operation, the charger must be installed such that risk of contact by people is reduced. The charger's AC plug must be located at least 18" above the floor/ground surface and the status display must be visible to the user.

2) Mounting Procedure:

Mount the charger by the mounting plate using appropriate fasteners (i.e.1/4" or M6 with locking hardware). For UL2202 compliance, a 12 AWG green bonding wire with ring terminals must be attached from the bonding stud located on the front of the charger (identified by) to the vehicle frame. The vehicle connection must be made using corrosion resistant hardware (e.g., a # 10stainless steel machine screw with at least two threads of engagement and, if required, a paint piercing washer).

3) DC Battery Connection Procedure:

a) The green wire outputs battery voltage when the charger is not plugged into AC to provide an interlock function—see fig.1. If used, a user-supplied 1 A fast-blow external fuse must be installed inline to prevent damage. Shorting or drawing more than 1 A may damage charger and



Battery and Charger

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void the warranty.

- b) Securely fasten the black ring terminal from the charger to the negative terminal".", "NEG",NEGATIVE") of the battery pack.
- c) Check that the correct charge algorithm is being used –refer to section 4). Securely fasten the red ring terminal to the positive terminal ("+","POS", "POSITIVE") of the battery pack.

Mechanical

All models	
Dimensions	28.0*24.5*11.0cm(11*9.7*4.3)"
Weight	<5kg(<11lbs) w/ standard output cord
Environmental	Enclosure:IP46
Operating Temperature	-30 °C to +50 °C (-22 °F to 122 °F), derated
	Above 30°C,below 0°C
Storage Temperature	-40 °C to +70 °C (-40 °F to 158 °F)
AC input connector	IEC320/C14(require>=1.8m localized cord)
DC output connector	OEM specific w/ 12AWG wire

Regulatory

Safely of Appliances/Battery Chargers
EV Charging System Equipment
Industrial Battery Charger
Battery Chargers-Industrial
Unintentional Radiators Class A
Radio disturbance characteristics(Class A)
Limits for harmonic current emissions
Limits of voltage fluctuations and flicker
Electrostatic discharge immunity
Radiated, radio -frequency, EMF immunity
Electrical fast transient/burst immunity
Surge immunity
Conducted Immunity
Voltage variations immunity



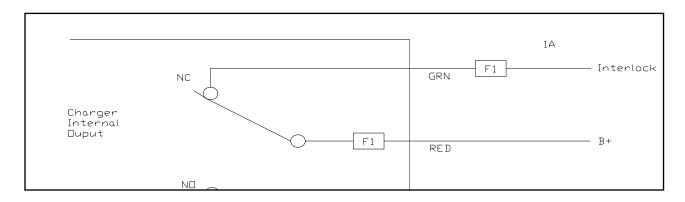


Figure 1

4) Check/Change Charging Algorithm:

The charger comes pre-loaded with algorithms for batteries as detailed in Table 1. If your specific battery model is not listed, please contact Delta-Q.

Each time AC power is applied with the battery pack NOT connected, the charger enters an algorithm select/display mode for approximately 11 second. During this time the current Algorithm # is indicated on the '80%' LED (Models 912-xx0x) or on the single LED(Models 912-xx1x). A single digit Algorithm # is indicated by the number of blinks separated by a pause, A two digit Algorithm # is indicated by the number of blinks for the first digit followed by a short pause. then the number of blinks for the second digit followed by a longer pause.

To check/change the charging algorithm:

- a) Disconnect the charger positive connector from battery pack. Apply AC power and after the LED test, the Algorithm # will display for 11 seconds.
- b) To change algorithm, touch positive connector during the 11 second display period to the battery pack's positive terminal for 3 seconds and then remove the Algorithm # will advance after 3 seconds. Repeat until desired Algorithm # is displayed. A 30 second timeout is extended for every increment.
 - Incrementing beyond the last Algorithm moves back to the first Algorithm.
 - After desired Algorithm # is displayed, touch the charger connector to the battery positive until the output relay is heard to click (~10 seconds)-algorithm is now in permanent memory.
- c) Remove AC power from the charger and reconnect the charger positive connector to the battery pack. It is highly recommended to check a newly changed algorithm by repeating step4) above.



Overview

The electric vehicle is provided with a 48V DC separately excited reversible traction motor. The separately excited motor can only be used on the E-merge electric vehicles. TOMBERLIN suggests that the electric motor that is in a bad state of repair should be sent to the special service store for repair. The technician who has knowledge and expertise about the service of the electric motor can perform some simple reparation.

Exterior inspection of the electric motor

Perform the following inspections and tests with the multimeter or circuit breaker without the need to disassemble the electric motor.

NOTE: Before disconnection, label the wires of the electric motor for easy identification.

Check Procedure 1—internal short circuit

Please refer to Chapter 1 "Safety Protection Measures".

- Disconnect the battery cable as specified. Please refer to Chapter 1 "Protection for Electrical Safety".
- 2. Hold the terminals with two spanners, and disconnect the wire from the connecting terminal of the electric motor.
- 3. Attach the black probe (-) of the multimeter set at 200Ω (ohm) to the motor enclosure. Scrape off the paint on the motor cover to ensure good connection. Attach the red probe (+) to the terminals of A1, A2, F1 and F2 separately (see Fig 12-1). The multimeter shows not-connected. In case of conducting state, the electric motor should be removed from the electric vehicle and be repaired by professionals. Please refer to Chapter 9 "Removal of Motor".
 - 3.1 The wrong readings on A1 or A2 terminals may imply three kinds of problems: A1 or A2 grounding, grounding of wires in the electric brush area or armature/commutator grounding. The wrong reading on F1 or F2 terminals mean F1 or F2 terminal grounding or excitation coil grounding.

Check Procedure 2—disconnection of armature circuit

Please refer to Chapter 1 "Safety Protection Measures".

- Disconnect the battery cable as specified. Please refer to Chapter 1 "Protection for Electrical Safety".
- 2. Hold the terminals with two spanners, and disconnect the wire from the A1 and A2 connecting terminals of the electric motor. Attach the red probe (+) of the multimeter set at 200Ω (ohm) to A1 and the black probe (-) to the A2 terminal. The multimeter should indicate connected. In case MFRGE 12-1



of wrong reading, the cause may be the off contact or poor contact of brush set and/or disconnection of armature winding. The electric motor should be removed from the vehicle and be repaired by professionals. Please refer to Chapter 9 "Removal of Motor".

Check Procedure 3—open excitation circuit

Please refer to Chapter 1 "Safety Protection Measures".

- Disconnect the battery cable as specified. Please refer to Chapter 1 "Protection for Electrical Safety".
- 2. Secure the terminals with two spanners, and disconnect wires from connecting terminals F1 and F2 of the electric motor. Attach the red probe (+) of the multimeter set at 200Ω (ohm) to F1 and the black probe (-) to F2 terminal. The multimeter should indicate connected. In case of wrong reading, the cause may be open excitation coil or poor contact of terminal bond. The electric motor should be removed from the vehicle and be repaired by professionals. Please refer to Chapter 9 "Removal of Motor".

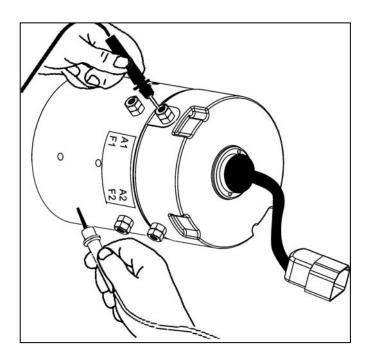


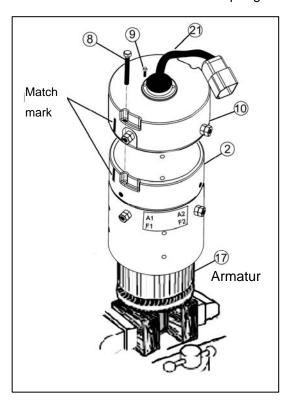
Fig 12-1: Inspection of the short circuit of electric motor

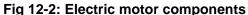


Removal of the electric motor

Remove the electric motor from the electric vehicle. Please refer to Chapter 9 "Removal of Motor".

- 1. Before removal, first mark match marks on the end shield of the electric motor and the stator enclosure, and then secure the electric motor to the pincer pliers with wooden block as shown (see Fig 12-2).
- 2. Unscrew the two bolts (8) securing the end shield (10) to the stator enclosure (2).
- 3. Unscrew the two screws (9) securing the speed sensor (2) to the end shield enclosure.
- 4. Remove the armature \bigcirc from the other end of the stator enclosure \bigcirc .
- 5. Unscrew the two screws 1 securing the brush gear 12 to the end shield 10 (see Fig 12-7).
- 6. Mark the brush terminals (A1 and A2) (3) to indicate their positions in the end shield (10). Then unscrew the nut (6), spring washer (7), small washer (3) and large washer (5) (see Fig 12-7). Insert the terminal into the interior of the stator enclosure through the enclosure wall.
- 7. Carefully remove the brush set and terminals from the end shield.
- 8. To remove the brush spring from the gear, pry out the elongation portion of the spring over the brush carrier. Then remove the spring from the installation buckle (see Fig 12-3).





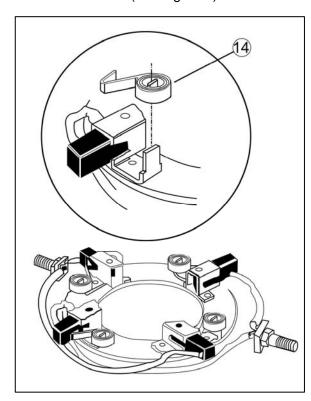


Fig 12-3: Remove the brush spring



Inspection and test of the motor element

Inspection of the armature

Disassemble the electric motor and carefully inspect the armature for any of the following characteristics:

- The insulating material is charred, carbonized or ruptured;
- The paint coating is abnormally hardened;
- Tip-off;
- The armature winding spreads outwards;
- · Armature core iron sheet is damaged;
- · The commutator is damaged or burnt;
- The commutator is very dirty or has oil strain;
- The commutator bar bulges up;
- Armature bearing shaft is abraded.

Clean and wipe of the water on the dirty or stained commutator. The abnormal phenomena during inspection can help spot the cause to the malfunction. The lightly coarse commutator can be polished by 400# or finer emery paper.

⚠ WARNING

• It is strictly prohibited to burnish the commutator with abrasive cloth. The grains on abrasive cloth are conductive, and may result in the short circuit of the commutator bar. It is prohibited to apply oil or lubricant to the commutator or brush.

NOTE: In case there is oil on the commuttor, the oil seal of the output shaft on the driving axle may be damaged.

Armature earth test

⚠ WARNING

- It is strictly prohibited to immerse the armature into any solvent.
 - NOTE: Before testing the armature, wipe the armature with a piece of clean cloth. Wipe out the carbon dust and metal particles between commutator bars.
- 1. Attach one probe of the multimeter set at $200\Omega(ohm)$ to the commutator and the other probe to the armature core. The multimeter should indicate un-continuity (see Fig 12-4). In case of wrong reading, the armature should be replaced.



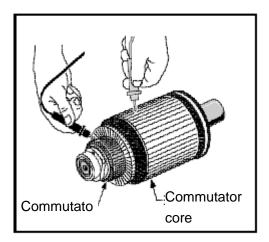
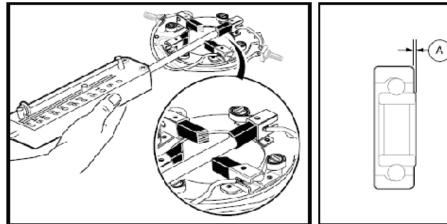


Fig 12-4: Armature inspection and test



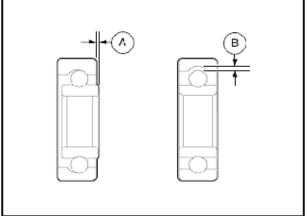


Fig 12-5: Brush spring elasticity test

Fig 12-6: Bearing inspection

Inspection of the excitation winding

The burnout or charring of the insulating material of the excitation winding means the electric motor is overheated due to the overloaded or grounded or short circuit coil winding. In case the insulating material of the excitation winding is charred, please replace the electric motor or the stator enclosure component.

Motor element

- 1. Inspect the insulator ④ for crack or other damages (see Fig 12-7).
- 2. Inspect the brush 🔞 for damage or heavy wear. Replace the brush when necessary.
- 3. Inspect the brush spring (see Fig 12-7). Replace the spring of which the color changes (amber or blue) due to being heated. Replace the spring of which the elasticity is smaller than 16 ounces (see Fig 12-5).



CAUTION

 To inspect the elasticity of the brush spring, it is strictly prohibited to excessively extend the spring. Excessive force may damage the spring.

NOTE: Once the brush is removed, the replacing one should be mounted. This can ensure that the connecting terminal and brush be properly aligned in the transmission gear. For the mounting of brush, please refer to "Assembly of the electric motor".

Once one brush is replaced, all the other brushes should also be replaced at the same time. Never replace only two of them.

Brushes should be mounted on the same transmission gear, and the two brushes connected should be symmetrically mounted.

Bearing inspection

- 1. Wipe off the carbon dust in the bearing with a clean cloth. Inspect the bearing through manual turn and inspection of the clearance in axial direction (A) and radial direction (B) (see Fig 12-6).
- 2. The bearing should be replaced with new one in case the bearing noise is too loud, unable to rotate smoothly or the clearance is too large. Inspect the bearing, and replace it in case the bearing rusts, is abraded or cracks or in case the color of the metal of the bearing changes abnormally. Do not remove the bearing from the armature shaft unless for replacement purpose.

Removal of the bearing

1. Secure the bearing puller to the bearing (15), and pull the bearing from the armature shaft. Support the shaft so that it will not fall off when the bearing is removed (see Fig 12-8). Reject the bearing.

Mounting of the bearing

Press the new bearing (3) against the armature (see Fig 12-7). Use only the hand arbor press that exerts pressure on the inside race.

NOTE: Before pressing the bearing to the armature, see to it to secure the large washer **②** to the armature shaft (see Fig 12-7).

The arbor of which the outside diameter is less than 5/8 inch (16mm) should be used to press the bearing to the armature.

Inspection of the speed sensor magnet

Inspect the speed sensor magnet (8) for abrasion or crack. Replace the magnet when necessary (see Fig 12-7).







Removal of the speed sensor magnet

Remove the bolts 9, and take down the speed sensor magnet 9 (see Fig 12-7).

Mounting of the speed sensor magnet

Mount the speed sensor magnet 8 to the shaft with bolts 9, and tighten the torque of the bolts with 22 inch pound $(2.5N \cdot m)$ $_{\circ}$

Readjustment of the electric motor

The electric motor should be readjusted by professional motor maintenance technician. The use of corresponding activities and procedures is crucial to the success of readjustment to the electric motor.



Specifications for the electric motor

Any readjustment must be carried out by professional technicians. The maintenance specifications for the electric motor are shown in the table below.

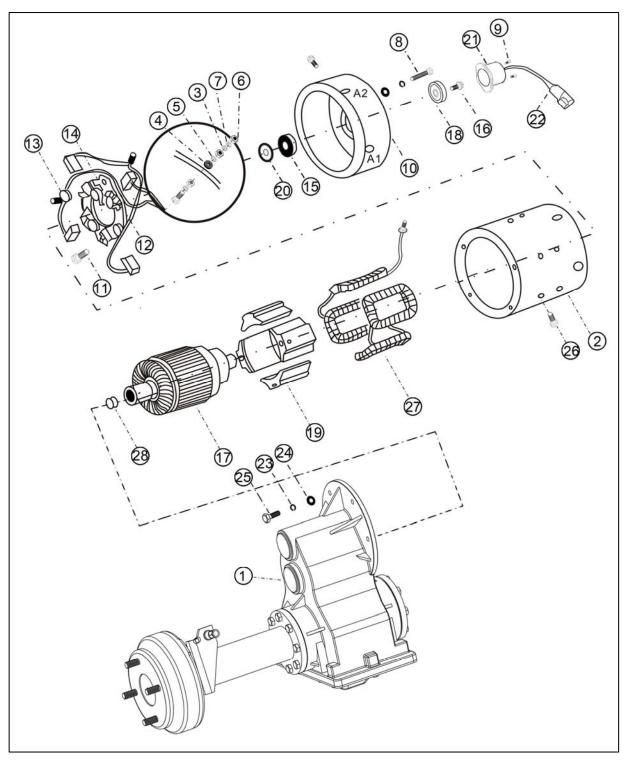


Fig 12-7: Electric motor



Items	Adjustment limits	
Commutator diameter (min)	2.265inch (66.675mm)	
Commutator coaxial shaft with armature shaft	0.001inch (0.0254mm)	
Maximum kerf depth in processing commutator	0.005inch (0.127mm)	
Oscillation of the commutator bars should not	0.002inch (0.00508mm)	
exceed:		
In case the undercut of the commutator segment		
insulator is smaller than 0.16 inch (0.406mm), the	0.031inch (0.8mm)	
undercut should be:		
Machined surface of the commutator	8-16microinch (203.2-	
	406.4nm)	
Resistance of the excitation coil (IQ system, 3.20hp)	1.61Ω (ohm)	

Assembly of the electric motor

- 1. In case the bearing is removed, the replacing one should be mounted. Please refer to "Mounting of the Bearing" in this chapter.
- 2. Mount the brush.

NOTE: Once the brush is removed, the replaced one should be mounted. This can ensure that the connecting terminal and brush be properly aligned in the transmission gear. For the mounting of brush, please refer to "Assembly of the electric motor".

Once one brush is replaced, all the other brushes should also be replaced at the same time. Never replace only two of them.

Brushes should be mounted on the same transmission gear, and the two brushes connected should be symmetrically mounted.

- 2.1. Secure the brush transmission gear a little higher than the top of end shield (10) and make it face upwards. Insert two terminals through the insulator to the end shield of A1 and A2. Insert the bolts (1) into the brush transmission gear to the threaded hole of the end shield (see Fig 12-9). Tighten the bolt with a torque of 22 inch pound (2.5N·m).
- 2.2. Press the elongated portion of the brush back to the original once a time, and push back the brush till all of them return to the installation grooves. Align the brush spring to one side of the brush so that the pressure of the spring can hold it in the retraction state (see Fig 12-3).



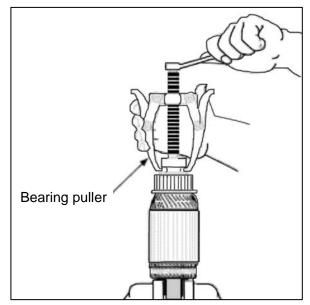


Fig 12-8: Removal of the bearing

- 2.3. Face the bearing end forward, and put the armature into the stator enclosure. While the positioning armature ensuring good contact of commutator/brush, the brush should be ensured to be held. Release the brush, and place the spring outside the brush so that the brush holds against the commutator.
- 3. Mount the end shield onto the stator enclosure.
 - 3.1. Align the match marks on the end shield and the stator enclosure before mounting two bolts **6** (see Fig 12-10). Tighten the bolt with a torque of 7.4 foot-pound (10N·m).
- 4. Ensure the free rotation of the armature. In case the armature cannot rotate freely, remove the electric motor to spot the problem. In assembly of the electric motor, see to it that the bearing is properly mounted in the end shield.



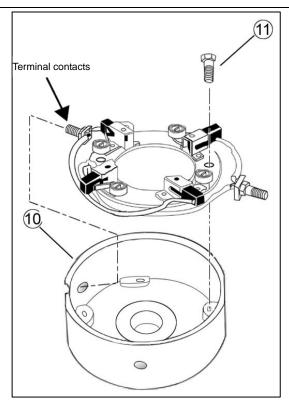


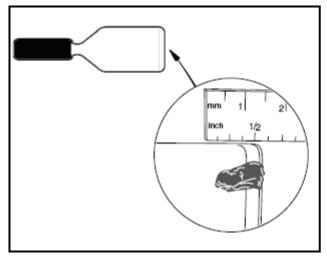
Fig 12-9: Mounting of the brush

Fig 12-10: Mounting of the end shield

Mounting of the electric motor

- 1. Clean the input shaft of the driving axle.
 - 1.1. Spray detergent over the input shaft.
 - 1.2. Wipe the input shaft with a piece of clean cloth.
 - 1.3. Inspect the groove of input shaft, and clean the remaining scraps.
 - 1.4. Repeat Step 1.1 to 1.3 until the input shaft is clean.
- 2. Lubricate the input shaft of the driving axle
 - 2.1. As shown in the figure, extrude about 1/2 inch (1.3cm) of NYE lubricating oil from the tube onto the putty knife (see Fig 12-11).
 - 2.2. Turn the wheel so as to rotate the input shaft.
 - 2.3. Evenly apply the motor coupling grease onto the rotating input shaft. Start the application from the position 1/8 inch (3.1mm) lower than the shaft end to the driving axle (far end of the shaft) (see Fig 12-12).
 - 2.4. The grease should be evenly applied in the groove, and the width should be about 3/8 inch (9.5mm).
 - 2.5. Erase the grease in one groove with a flat-head screwdriver so that air can be vented when the electric motor is put to the input shaft.





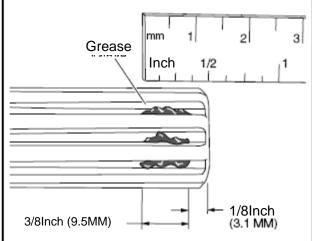


Fig 12-11: Apply grease onto putty knife

Fig 12-12: Apply grease into input shaft grooves

- 2.6. Inspect the chamfer and end of the input shaft to ensure that areas shown in the figure are free of grease (see Fig 12-14).
- 3. Mount the buffer.
 - 3.1. Mount the buffer 28 into the motor coupling (see Fig 12-7).

NOTE: The motor coupling must be free of grease or scrap.

- 3.2. Ensure that the mounted buffer is situated at the bottom of the coupling.
- 4. Mount the electric motor on the driving axle.
 - 4.1. Fit the motor coupling over the input shaft of the driving axle.

NOTE: The coupling will squeeze redundant grease on the input shaft towards the driving axle. When the electric motor is fitted over the input shaft, the clearance between the electric motor and the driving axle enclosure is about 1/16 inch (1.6mm) (see Fig 12-14).

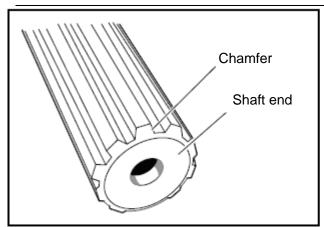
- 4.2. Mount the six bolts and washers of the fixed electric motor on the driving axle. Do not tighten them.
- 4.3. Tighten the bolts with hand (1 and 2) in the order shown in the figure (see Fig 12-15).
 Continue to tighten the bolts with hand until the electric motor is secured to the driving axle enclosure.

Δ NOTE:

Ensure the electric motor is correspondingly secured to the enclosure of the driving axle

Failure to mount in the right order and screw down the mounting bolt of the electric motor with a certain torque will result in the motor noise during operation.





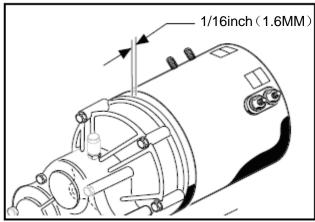


Fig 12-13: Clean the chamfer and input shaft end

Fig 12-14: Clearance of electric motor and driving axle

- 4.4. Tighten the bolts ②, ③, ④, ⑤ and ⑥ in turn with a torque of 6.3 foot-pound (9N⋅m). (see Fig 12-15)
- 4.5. Install the electric motor wires. Ensure that they are connected with the right terminals of the electric motor and that the terminals orientation are right. Please refer to the wiring diagram on page 9-7. Tighten the clamp nuts of the terminal with a torque of 7.5 foot-pound (10.2N·m).
- 4.6. Fasten the armature wire and electric excitation wire with binding tape so as to prevent the electric motor wire from contact with the electric motor or the driving axle when the electric vehicle is in operation.
- 4.7. Connect 3-wire speed sensor wires and electric vehicle harness.
- 5. In case the wheels are removed, mount them and tighten the wheel nuts with fingers.
- 6. Turn the TOW/RUN switch to the TOW position. To connect the battery, first connect the positive electrode (+) cable, then tighten it with a torque of 110 inch pound (12.4N·m). Apply the antirust oil on all connecting terminals to minimize future corrosion.
- 7. Set the Tow/Run switch at the RUN position.
- 8. Inspect the electric vehicle for normal operation.
 - Ensure the electric vehicle is moving forward when the Forward/Reverse switch is at FORWARD position.
 - Ensure the electric vehicle is moving backward when the Forward/Reverse switch is at REVERSE position. When the Forward/Reverse switch is at REVERSE position, the backing-up buzzer should give off an audible alarm.
- 9. Ensure the electric vehicle is not moving when the Forward/Reverse switch is at NEUTRAL position.



Speed sensor of the electric motor

Inspection of the speed sensor of the electric motor

Please refer to Chapter 10 "Check Procedure 9"

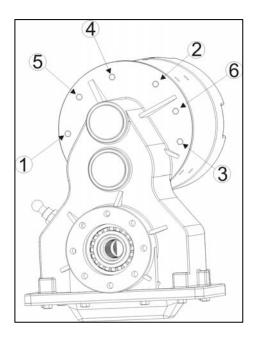


Fig 12-15: Electric motor frame

Removal of the speed sensor

- 1, Disconnect the battery cable as specified. Please refer to Chapter 1 "Protection for Electrical Safety".
- 2. Unplug the three-wire connector 2 from the hardness of the electric vehicle (see Fig 12-16).
- 3. Take down the speed sensor ② of the electric motor from the end shield of the electric motor with a screwdriver.
- 4. Remove the speed sensor magnet (1) from the armature end with a spanner.

Mounting of the speed sensor of electric motor

- 1. Mount the speed sensor magnet, and tighten the bolts with a torque of 110 inch pound (12.4N·m) (see Fig 12-16).
- 2. As shown in the figure, align the speed sensor 2 and secure it with the screwdriver.
- 3. Plug the three-wire connector ② onto the harness of the electric vehicle.



4. Turn the TOW/RUN switch to the TOW position. To connect the battery, first connect the positive electrode (+) cable, then tighten it with a torque of 110 inch pound (12.4N·m). Apply the antirust oil on all connecting terminals to minimize future corrosion.

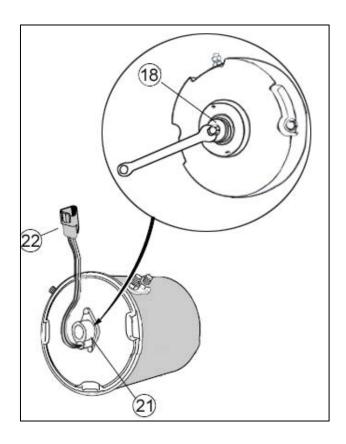


Fig 12-16: E-merge electric motor speed sensor



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